Chicago River Corridor Design Guidelines And Standards

City of Chicago

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Chapter One: Introduction

The Chicago River is one of Chicago's most precious and recognized natural resource. Winding its way through the length of the city, it offers a peaceful, natural contrast to the urban environment. For most of Chicago's history, the river has been an important working asset, serving as the city's harbor, supplying water for industry, and carrying away waste water. In the process, the river has been neglected and abused. Renewed development and changes in technology have made it possible to reclaim the river as an aesthetic and recreational resource to improve the quality of life for all Chicagoans.

The framework for the revitalization of the Chicago River is provided by the **Chicago River Corridor Development Plan**. The five goals of this plan are to:

- Create a connected greenway along the river, with continuous multi-use paths along at least one side of the river.
- Increase public access to the river through the creation of overlooks and public parks.
- Restore and protect landscaping and natural habitats along the river, particularly fish habitat.
- Develop the river as a recreational amenity, attracting tourists and enhancing Chicago's image as a desirable place to live, work, and visit.
- Encourage economic development compatible with the river as an environmental and recreational amenity.

Since the implementation of the **River Plan**, there has been a significant amount of public and private investment that have transformed abandoned, underused waterfront areas into new parks and trails, mixed-use and residential projects, and industry. New riverfront communities have emerged, land values have increased, water quality has improved, and the river has become a prime destination as the City's greatest natural amenity after the lake.

1.1 Role of Design Guidelines and Standards

The **Chicago River Corridor Design Guidelines and Standards** outline the requirements for development in and adjacent to the setback area along the Chicago River and its branches within the city limits. Setbacks are a very important planning and zoning tool. They provide space for the development of important greenway corridors, multi-use trails, and riverwalk amenities.

The role of the Design Guidelines and Standards is to outline the City's goals, expectations and requirements for development along the Chicago River.

Appropriately developed, the river corridor will provide additional open space and recreational opportunities, increase property values, economic vitality, increase environmental awareness, and enhance Chicago's attractiveness as a tourist destination. The **Design Guidelines and Standards** address development options along the river, including but not restricted to architectural treatments,

building construction, parking, fencing, lighting, landscaping, and riverbank treatments. Specific information relating to appropriate riverbank treatments, permit requirements, site furnishings, elements, construction materials and specifications may be found in the Appendices.

1.2 Applicability of Design Guidelines and Standards

Design Guidelines and Standards apply to all new development within 100 feet of the Chicago

The Chicago Zoning Ordinance (Municipal Code of Chicago, Title 17 Section 8-0912) requires that all new development within one hundred (100) feet of Chicago waterways, with the exception of single family homes, two flats and three flats, be processed as planned developments, subject to review and approval by the City of Chicago Department of Planning and Development, the Chicago Plan Commission, and the Chicago City Council. The ordinance further requires new developments to provide a thirty (30) foot setback from the river and comply with with general goals of the waterway design guidelines established by the Chicago Plan Commission. Those development projects not subject to the Chicago Plan Commission approval are urged to voluntarily comply with these guidelines.

The **Design Guidelines and Standards** provide the basis for review for riverside planned developments by the Department of Planning and Development. Upon completion of review, a description of the applicant's proposal and obligations will be incorporated into the planned development ordinance, subject to approval by the Chicago Plan Commission and the Chicago City Council, and enforceable through the Zoning Administrator.

1.3 Precedence of Design Guidelines

This document replaces the 1999 edition of the **Chicago River Corridor Design Guidelines and Standards** and the 1990 **Chicago River Urban Design Guidelines for the Downtown Corridor.**

1.4 Review by Other Public Agencies

In addition to the City of Chicago planned development approval process, riverside projects that include modification of the riverbank may require permits from the following state and federal authorities:

> **U.S. Army Corps of Engineers** - has jurisdiction under Section 10 and 404 of the Rivers and Harbors Act to issue regional permits, individual permits, and letters of permission for construction on waterways.

Illinois Department Natural Resources / Office of Water Resources - requires permits for construction activity in waterways of the State of Illinois.

Illinois Environmental Protection Agency - issues permits under Section 404 of the Clean Water Act for projects that may have chemical, physical or biological impacts on the waterway.

City of Chicago Department of Transportation Division of Engineering- issues harbor permits for construction within 40 ft of a waterway.

Metropolitan Water Reclamation District of Greater Chicago - may require approval for construction projects on the Chicago River that may impede its hydraulic flow. The MWRD owns portions of the Chicago River and leases them to private parties; these leases may impose additional requirements.

U.S. Coast Guard - approval is required for activity that may impinge on the navigation interests and safety of the Chicago River.

Illinois Environmental Protection Agency - issues National Pollutant Discharge Elimination System (NPDES) permits for industrial discharges, stormwater sewer point discharges, and earth moving construction projects, disturbing at least one acre of land, that may discharge pollutants into water bodies.

1.5 Areas Affected by the Design Guidelines and Standards

These guidelines apply to all branches of the Chicago River and connected waterways within the boundaries of the City of Chicago. (see Figure 1.1)

- Main Branch of the Chicago River
- North Branch of the Chicago River
- North Branch Canal (on the east side of Goose Island)
- North Shore Channel
- South Branch of the Chicago River
- Sanitary and Ship Canal
- South Fork of the South Branch of the Chicago River (‘Bubbly Creek’)
- Associated slips and inlets along the South Branch and Sanitary and Ship Canal

The Design Guidelines are intended for use by property owners, developers, designers, individuals, and civic groups interested in development along the Chicago River.

1.6 Outline of Design Guidelines and Standards

The **Design Guidelines and Standards** are organized into six chapters:

- Setbacks
- Riverbank Zone
- Urban Greenway Zone
- Development Zone
- Bubbly Creek Development Guidelines
- Appendices (Design Specifications)

Figure 1.1 Map of Chicago River

1.7 Setbacks

A setback defines the requirements for the minimum distance between new development and the river. Setbacks are required for all new development, but do not apply to existing buildings or development. Persons responsible for projects along the Chicago River should consult the "Setbacks" section of this document before preparing development or architectural plans for a river edge site.

1.8 Riverfront Development Zones

Land adjacent to the Chicago River can be categorized into three zones:
(see Fig. 1.2)

- Riverbank Zone, between the water's edge and the top of bank
- Urban Greenway Zone, between the top of bank and the river setback
- Development Zone, on the land side of the river setback

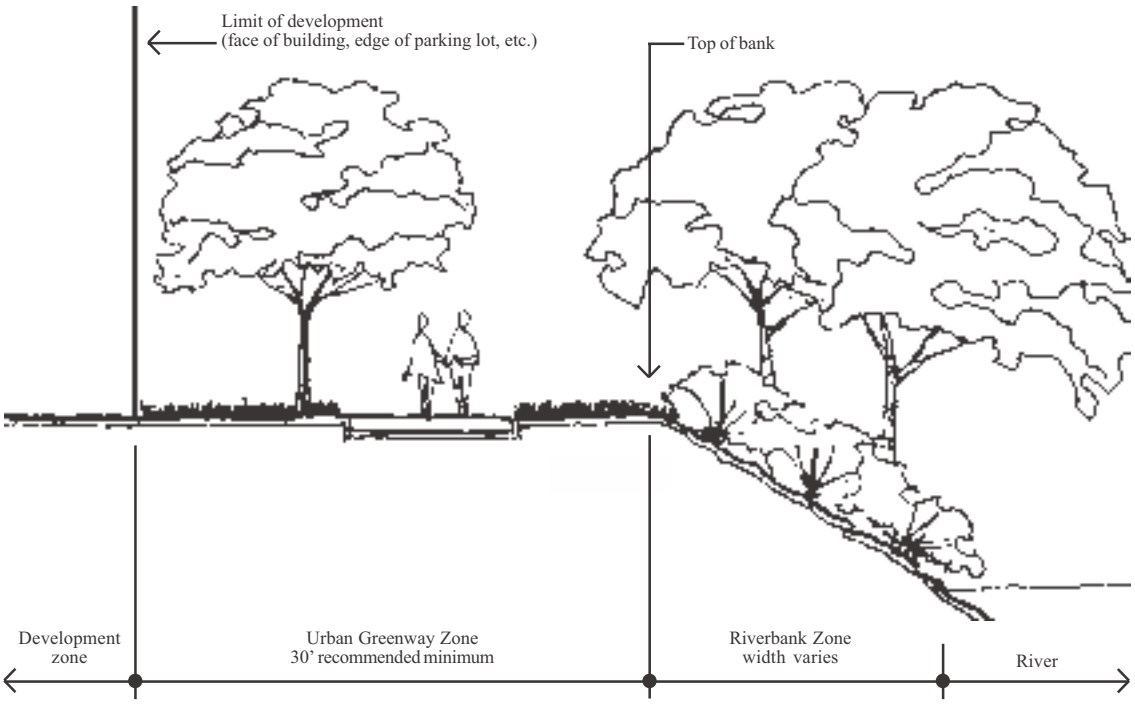


Figure 1.2 Typical riverbank section

1.9 Riverbank Zone

The riverbank zone is the area adjacent to the river between the water's edge and the top of bank. Where there is no bank, but rather a vertical bulkhead or other engineered vertical structure, there is no riverbank zone.

The riverbank zone should not be developed or disturbed except for environmental restoration, landscaping, and nature trails, so that it can act as a buffer between the river and adjacent uses and enhance the natural aspects of the continuous greenway corridor. Exceptions to this principle include development or construction required by river dependent uses and existing buildings or structures.

1.10 Urban Greenway Zone

The urban greenway zone is the area between the top of bank and the development zone, and should be developed with landscaping and a recreational multi - use trail. Exceptions to this principle include development or construction required by river dependent uses, incompatible industrial use, and existing buildings or structures.

1.11 Development Zone

The development zone is the area adjacent to, and on the land side of, the urban greenway zone. The development zone is the area where renovation, redevelopment, or new development will occur. Such development may be commercial, residential, institutional, or any other use permitted by the zoning for the site.

1.12 Bubbly Creek Development Guidelines

In the Bubbly Creek river corridor, the river setback is expanded from thirty (30) feet to sixty (60) feet for the purpose of stormwater management and environmental protection. This chapter addresses the specific requirements for new development within the 60 foot setback area.

1.13 Appendices

Detailed specifications for site furnishings, elements, construction materials, and requirements are presented to facilitate continuity of appearance and functionality of river development sites.

Chapter Two: Setbacks

2.1 Applicability

A setback is a important zoning tool used to regulate and direct development on individual parcels of land to preserve or achieve a public good or benefit. The most common example of zoning setbacks are front yard, rear yard, and side yard setbacks, which bring order to the street facades of buildings and preserve open space around and between buildings.

A setback is a zoning tool used to regulate development to preserve or achieve a public good.

It is important that new development be set back from the Chicago River to protect the natural, scenic, recreational, historical, and economic resources of the river; and to preserve the potential for future development of greenway corridor improvements; and for the development of public access or multi - use trails.

New development must be set back a minimum of thirty (30) feet from the top of the bank of the Chicago River, except for the South Fork of the South Branch (Bubbly Creek), where sixty (60) feet is required (see Chapter 6 for Bubbly Creek guidelines).

Minimum set back requirements: 30 feet setback required along the Chicago River.

60 feet setback required on Bubbly Creek.

The setback should be measured horizontally from the top of the bank, rather than from the water's edge, because the riverbank itself can be very steep and may not be suitable or wide enough for landscaping or a multi - use trail.

2.2 Exceptions

A Setback is not required for:

- Existing structures or buildings that are within the setback zone
- New single - family homes and two flats and three flats
- River dependent uses

River dependent uses are those uses or activities that can be carried out only on, in, or adjacent to a waterway because the use requires access to the waterway and cannot be located inland (see Appendix 1 for a listing of river dependent uses).

2.3 Improvements or Structures Permitted in Setback Area

- Paved or unpaved walkways
- Projections from buildings in the private development zone, including but not limited to awnings and canopies, bay windows and balconies, overhanging eaves and gutters, provided the projection does not extend three (3) feet or more into the setback area, and has a minimum clearance of ten (10) vertical feet from setback grade.
- Arbors and trellises
- Fences and walls not exceeding 6 feet in height
- Light standards, benches, drinking fountains, and other riverwalk amenities
- Wheelchair lifts and ramps that meet federal, state, and local accessibility standards for persons with disabilities

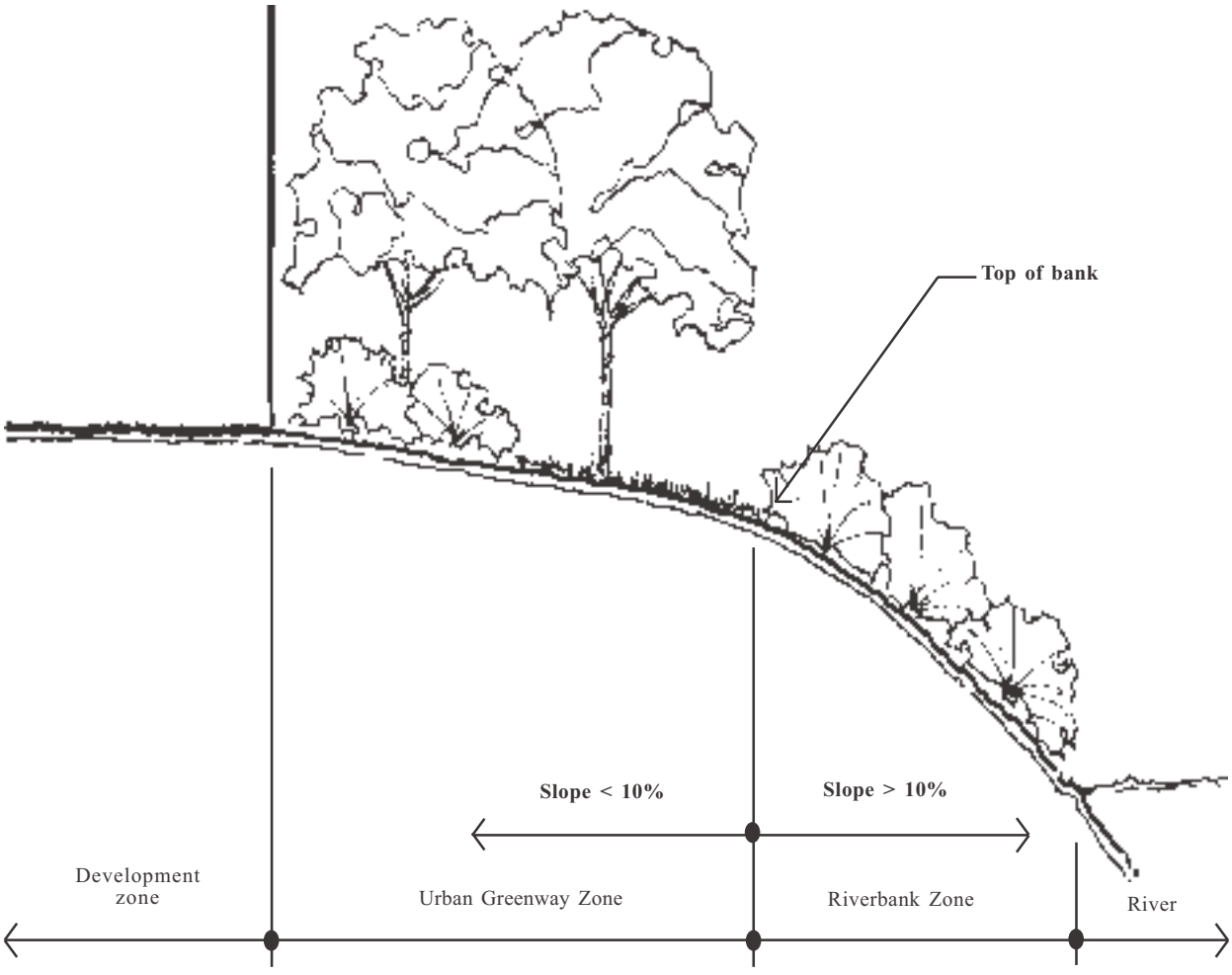
2.4 Improvements or Structures Not Permitted in Setback Area

- Buildings or structures of any kind (except as noted below)
- Vehicular use areas (parking lots, driveways, service drives, loading docks, vehicular staging or storage areas, etc.)
- Overhead utilities
- Private yards, patios, terraces or decks

2.5 Definition, Top of Bank (sloped bank)

Where the bank is sloped, the "top of bank" is defined as the point at the top of the slope where the slope becomes less than 10 percent (see Fig. 2.1). Where there is a terrace or "bench" in the slope, the top of bank is the point furthest from the water's edge where the slope becomes less than 10 percent.

Figure 2.1 Characteristics of sloped banks



2.6 Definition, Top of Bank (vertical bulkhead or seawall)

Where there is a vertical bulkhead or seawall or other engineered structure, the "top of bank" is defined as the point at the top of the bulkhead on the river side (see Fig. 2.2). Where the bulkhead is not in a straight line, the top of bank is defined as the line between points on top of the bulkhead located continuously over land, and does not cross over the water. Where there is a terrace or "bench" between two bulkhead walls, the top of bank is the line furthest from the water's edge.

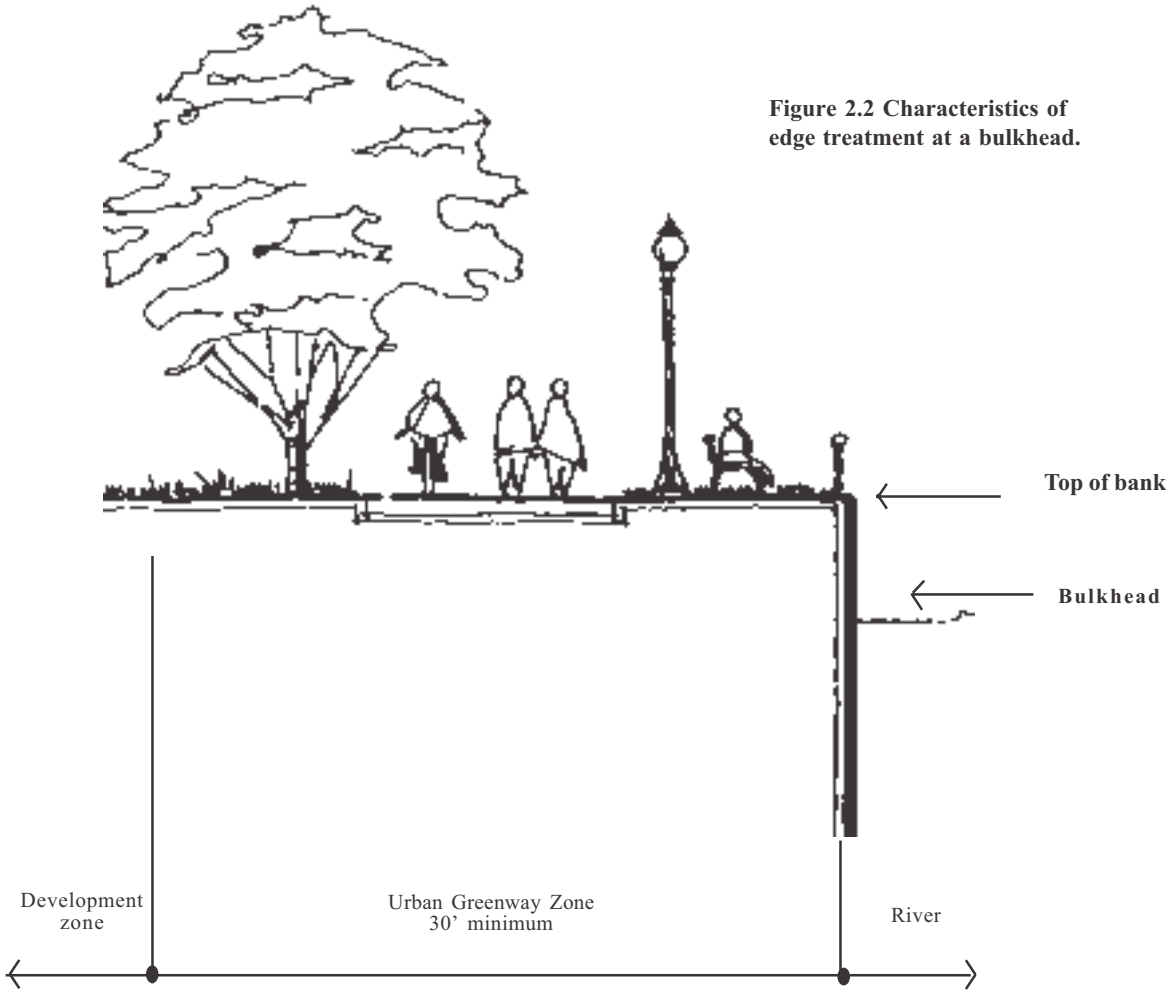


Figure 2.2 Characteristics of edge treatment at a bulkhead.

2.7 Zoning Bonuses for Setbacks

The Chicago Zoning Code (Chapter 17-4-1006) provides floor area bonuses for riverside projects in downtown zoning districts that provide a river setback space exceeding the required minimum 30 feet.

Chapter 17-4-1012 provides floor area bonuses for water features built within the public riverwalk setback area.

Consult the Chicago Zoning Ordinance for details regarding bonuses for river amenities.

2.8 Variances

In certain cases a setback less than the recommended 30 feet may be permitted in order to address constrained sites; small, irregularly shaped sites; and to allow flexibility for optimal site plans.

In certain cases, variances are permitted in the setback zone to accomodate irregular and constrained sites.

Maximum variance (depth): Structures and private yards may encroach into the 30-foot river setback a maximum of ten (10) feet, so that the minimum setback is never less than twenty (20) feet from the top of bank.

Maximum variance (length): Structures and private yards may encroach into the required river setback, provided that the encroachment, or the area with a reduced setback, occurs along a maximum of one - third (1/3) of the site's river frontage, measured in linear feet (LF), so that the required setback never occurs along less than two – thirds (2/3) of the site's river frontage.

2.9 Mitigation for Variances

To mitigate for the loss of riveredge open space in the setback zone due to the encroachment of structures or private yards where a setback less than the recommended has been permitted, additional open space must be provided elsewhere on site according to the following guidelines:

Requirement for additional open space for mitigation of variances: Where structures and/or private yards encroach into the river setback and urban greenway zone, and the setback is therefore less than thirty (30) feet from the top of bank, additional land free of structures, which is not defined or developed as a private yard, should be provided adjacent to the river setback and urban greenway zone to compensate for the loss of open space.

Amount of additional open space for mitigation of variances: Additional land should be provided adjacent to, and contiguous with, the setback zone at a rate of 2.5 times the land or open space lost to the encroachment.

Proportion of additional open space for mitigation of variances: Additional open space must have proportions of no more than two (2) feet of depth (perpendicular to the setback line) per one (1) foot of frontage along the river setback line, in order to avoid excessively long or deep and narrow parcels of land that could be relatively or completely unusable and have little or no public benefit.

Additional land should be provided at the rate of 2.5 times the area lost to development.

2.10 Example of Amount of Additional Open Space Required in Mitigation of a Setback Variance

A parcel with 300 feet of river frontage may have a reduced setback of no less than 18 feet for up to no more than 100 feet, or one - third of the river frontage. The remaining 200 feet, or two – thirds of the river frontage, should have the standard 30 foot setback. The total amount of land free of structures should be as follows:

100 Lineal Feet x 12 feet (reduction from 30 foot to 18 foot setback) = 1200 Square Feet (total land lost in the setback zone)

1200 Square Feet x 2.5 (replacement ratio) = 3000 Square Feet (total amount of additional open space required)

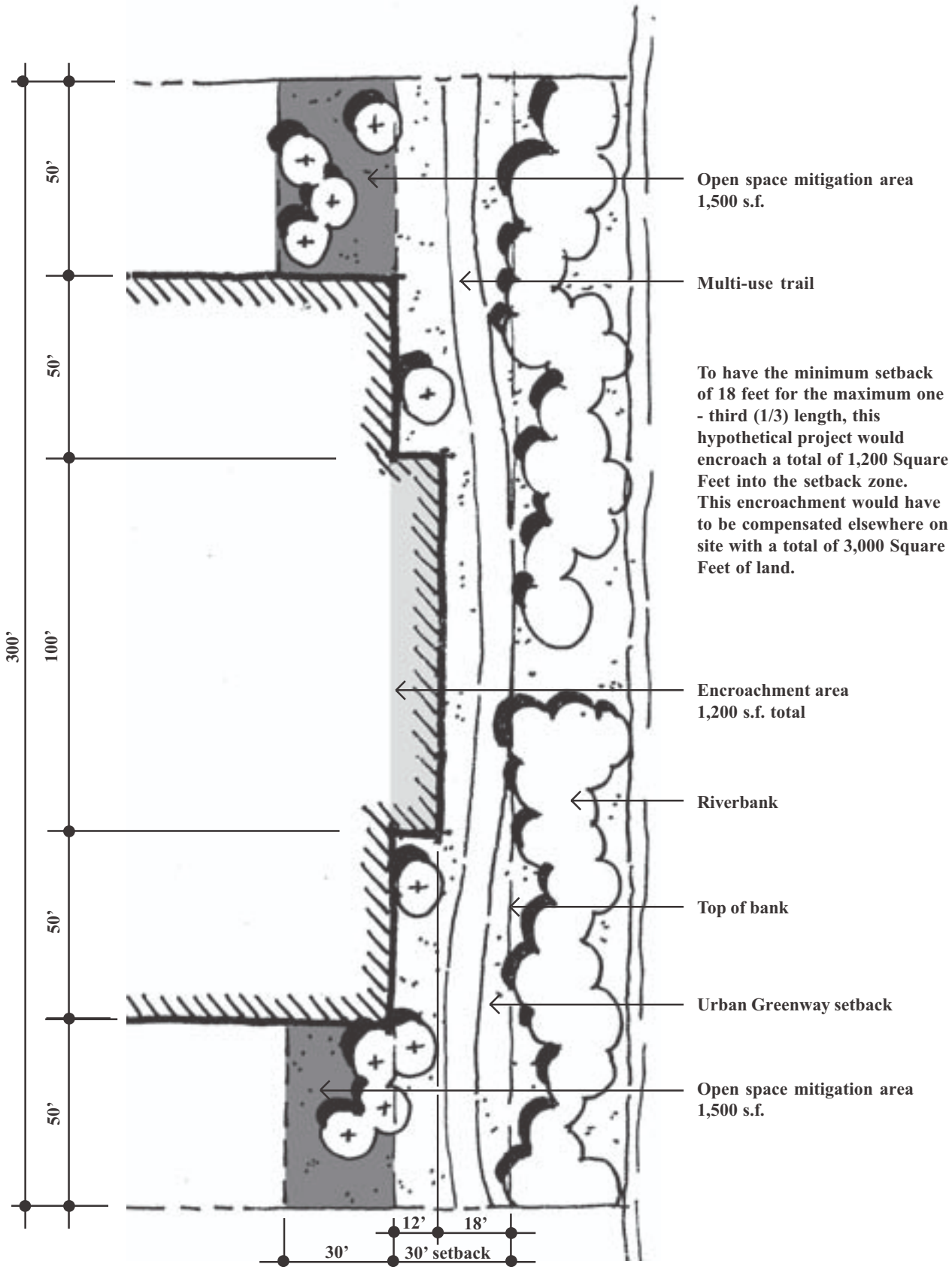

50’
50’
50’
50’
300’
100’
Open space mitigation area
1,500 s.f.
Multi-use trail
To have the minimum setback of 18 feet for the maximum one - third (1/3) length, this hypothetical project would encroach a total of 1,200 Square Feet into the setback zone. This encroachment would have to be compensated elsewhere on site with a total of 3,000 Square Feet of land.
Encroachment area
1,200 s.f. total
Riverbank
Top of bank
Urban Greenway setback
Open space mitigation area
1,500 s.f.
12’
18’
30’
30’ setback

Figure 2.3 Example setback variance

Chapter Three: Riverbank Zone

3.1 Definition of Riverbank Zone

The riverbank zone is the area adjacent to the river between the water's edge and the top of bank. Where there is a vertical bulkhead or other engineered vertical structure there is no riverbank zone. See the "Setbacks" section for a definition of the water's edge and the "top of bank."

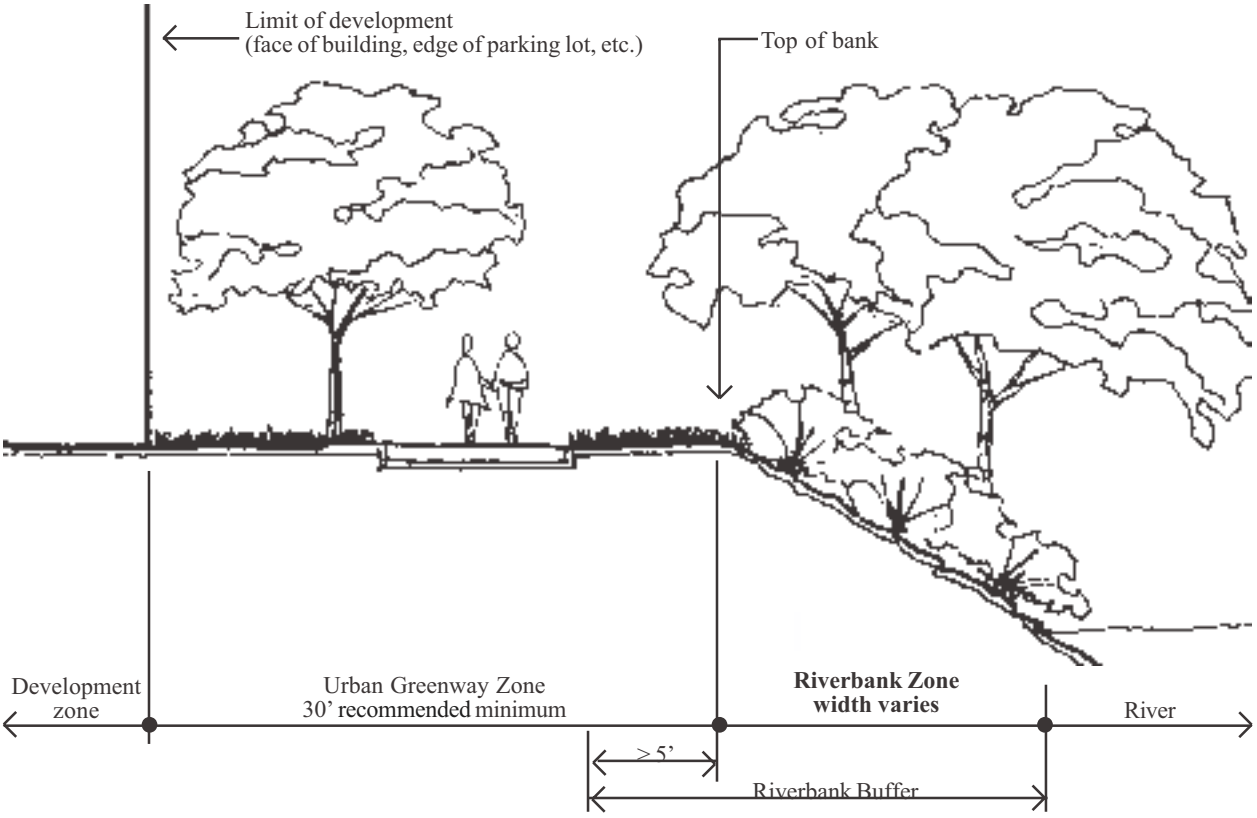


Figure 3.1 Typical riverbank section

3.2 Responsibility for the riverbank

The Chicago Municipal Code requires riverfront property owners to maintain riverbanks, seawalls, and other attached structures on their property from deterioration that may endanger the health or safety of individuals or impair river navigation (see Appendix J).

Land owners are responsible for the condition of their riverbank or seawall.

3.3 Riverbank Buffer

Objectives within the riverbank buffer include (see Fig. 3.1):

- New developments should create, restore, and protect riverbank buffers along the river in order to stabilize riverbanks, provide wildlife habitat, protect water quality, and provide an appealing natural environment.

The Riverbank Buffer should be managed as a natural area.

- The riverbank buffer should be managed as a natural sloped bank, utilizing native riparian vegetation and avoiding incompatible structures.

- Where natural riverbanks exist, care should be taken to preserve the natural slope to the extent possible by selective thinning and pruning of weedy and dead vegetation. However, if the steepness of the bank poses a stability and environmental hazard, the bank will have to be recontoured and replanted with native riparian vegetation.

- The riverbank buffer should extend from the water's edge to the edge of the riverwalk path or a minimum of the first twenty (20) feet of the urban greenway zone adjacent to the top of bank, whichever is less. The multi-use trail or its shoulder shall not be located less than five (5) feet from the top of bank.

3.4 Bank Treatment

The riverbank buffer zone should be managed as a natural area, utilizing native riparian and prairie vegetation and avoiding incompatible structures. Degraded riverbanks will lead to higher erosion rates and habitat destruction, water quality impairment, and other threats to infrastructure. In contrast, a natural riverbank will become stronger over time as the native vegetation roots and anchors itself to the riverbank soils.

3.5 Appropriate Bank Treatments

The goal of riverbank treatment, where there is a sloped or "natural" bank, is to create an environmental buffer and to preserve, restore, or create a naturalistic appearance. Recommended bank treatments may be found in Appendix K.

New riverbanks need to be regraded to a minimum 3H:1V slope.

Bank steepness. Excessively steep slopes, especially those with soil erosion and / or are steeper than the "angle of repose" of the soil, should be regraded to a minimum 3:1 (horizontal to vertical) slope that can be planted and maintained with naturalistic plantings. This treatment will minimize or eliminate soil erosion.

Bank profile. The grading and profile of the regraded bank should vary to be steeper in some places, gradual in others, and not be a single, consistent profile for the entire length.

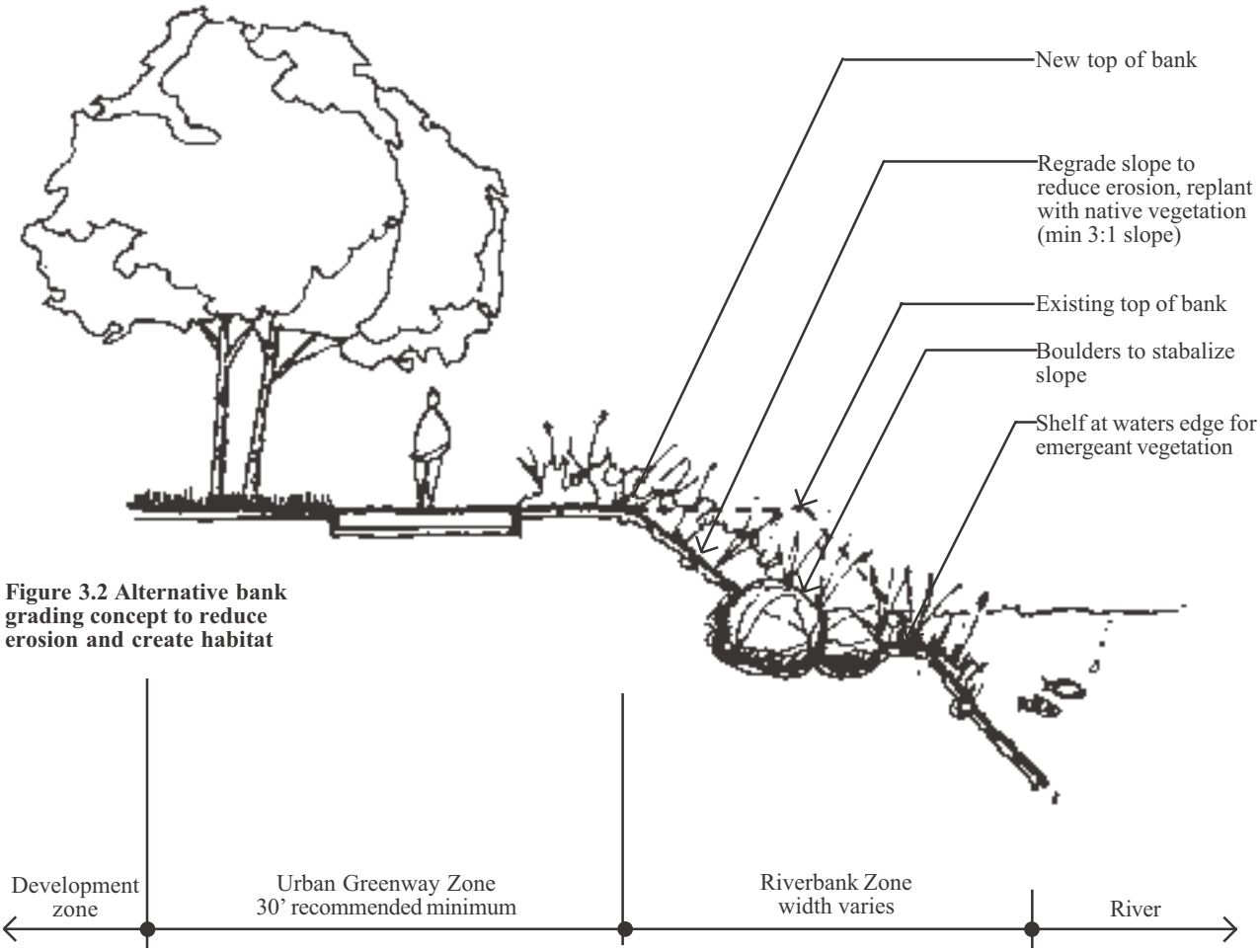

New top of bank
Regrade slope to reduce erosion, replant with native vegetation (min 3:1 slope)
Existing top of bank
Boulders to stabalize slope
Shelf at waters edge for emergeant vegetation
Development zone
Urban Greenway Zone
30' recommended minimum
Riverbank Zone
width varies
River

Figure 3.2 Alternative bank grading concept to reduce erosion and create habitat

Bank stabilization. The riverbank should be stabilized to meet the environmental and aesthetic objectives of the riverbank buffer, and may require the use of an erosion control blanket, geotextile reinforcement, or armoring of the toe of the bank.

Native vegetation. Native vegetation adapted to the riparian zone should be used. The recommended reference for native plants is the "Native Plant Guide for Streams and Stormwater Facilities in Northeastern Illinois," which has been incorporated into the Recommended Plant Palette in Appendix E.

Structures and fixtures within the riverbank buffer. Structures should not be located within the riverbank buffer, with the exception of those required by river dependent uses. Fixtures associated with the multi - use trail, that include ramps, steps, and fishing platforms are permitted within the buffer, but should be consolidated in a single area, rather than distributed throughout the buffer.

Figure 3.3 Example of natural riverbank with native plants

Clean - up. Garbage, litter, rubble, paving materials, construction materials, and any other unnatural, unattractive, or inappropriate materials shall be removed from the riverbank.

Surface treatment. Paving or other hardening of the bank with engineered treatments is undesirable and should be avoided for non-access related purposes. Such treatments include, but are not limited to, concrete and timber crib walls, retaining walls, "reinforced earth" retaining walls, concrete and asphalt paving, gabions (rock - filled wire baskets), gabion mats (rock - filled wire blankets), concrete - filled fabric blankets, cells, or bags, rip rap (broken stone installed on the surface of the bank), and other engineered or paving solutions.

Figure 3.4 Example of riverbank with inappropriate surface treatment

Figure 3.5 Example of effective and appropriate stabilization of riverbank

Soil erosion. To minimize or eliminate soil erosion on the banks and sedimentation in the water, sloped banks should be planted such that there are no bare areas. On steeper slopes, soil erosion control blankets or geotextile reinforcement will be necessary.

Toe of bank stabilization. Waterline erosion the result of fluctuating water levels and wakes will contribute to the continued erosion and scour of the bank. In these conditions, armoring of the toe of the bank with rip rap or other material is required.

Figure 3.6 Beaver Protection

Beaver protection. Beavers are becoming more prevalent on the Chicago River and pose a threat to trees. Preventive measures, such as galvanized wire fence of at least 3 feet tall warapped around the base of trees, are recommended to discourage beavers from gnawing on trees.

Stormwater discharge. Chicago's **Water Agenda** promotes efforts to protect, conserve, and manage the City's water wisely to improve the quality of life for residents and future Chicagoans. New developments along the Chicago River are required to direct stormwater discharge into the river and attain 80% of total suspended solids removal, preferably through above ground stormwater best management practices that include rain gardens, bioswales, infiltration areas, green roofs, and permeable pavements.

Figure 3.7 Example of Construction Site with Tree Protection Fence

Figure 3.8 Example of Bioswale and Permeable Pavements

3.6 Preservation, Restoration, and Implementation of Planting and Habitat

A landscape plan should be prepared to identify vegetation to be removed or preserved. Soil Erosion and Sediment Control Plans are required for any construction activity along the waterway, and should be consistent with the National Resource Conservation Service **Illinois Urban Manual.** Existing native riparian and aquatic planting contributes to the natural and scenic qualities of the greenway corridor, providing habitat for birds, fish, and other wildlife. These native plantings should be preserved.

Grading. Existing planting and habitat, both aquatic (in - water) and riparian (adjacent to the water), should be preserved to the extent possible to establish an environmentally stable natural riverbank.

Protection. Existing planting and habitat should be protected during construction by installing a tree protection fence at the top of the bank (maintained throughout the construction period). Where grading or other construction or development activities must occur on the riverbank, such areas should be no larger than required, and should be protected by a tree preservation fence around the area in question (see Fig. 3.7).

New planting. Advice from an expert in plant selection should be sought before installing new plantings. Existing vegetation should be supplemented with new native plant species to provide habitat for birds, fish, and other animals. Understory shrub and tree planting provide shade cover for fish and serve as a food source (fruits, seeds, etc.) for birds and small mammals.

Existing native plantings contribute to the natural and scenic values of the greenway corridor providing habitat for birds, fish, and other animals.

Ideally, live planting should be done in the spring (April-June) or fall (September-November) when the temperature is cooler to ensure the plant a greater chance of survival. Some plantings are only suited to spring installation. In areas where seeding is appropriate, a cover crop such as seed oats with a biodegradable soil stabilization mat should be used to establish a stable vegetative cover.

Formal vs. informal landscape treatment. Naturalistic plantings is preferred except in densely built up areas such as downtown that are characterized by high seawalls, hardscaped plazas, and high pedestrian traffic. In these areas more formalized landscape treatment is appropriate.

3.7 Appropriate and Inappropriate Plants

Appropriate plants. Plants on the portion of the riverbank subject to inundation and fluctuating water levels should be riparian or floodplain species. See “Recommended Riverbank Plant Palette” in the Appendix E for a detailed list of recommended plant species.

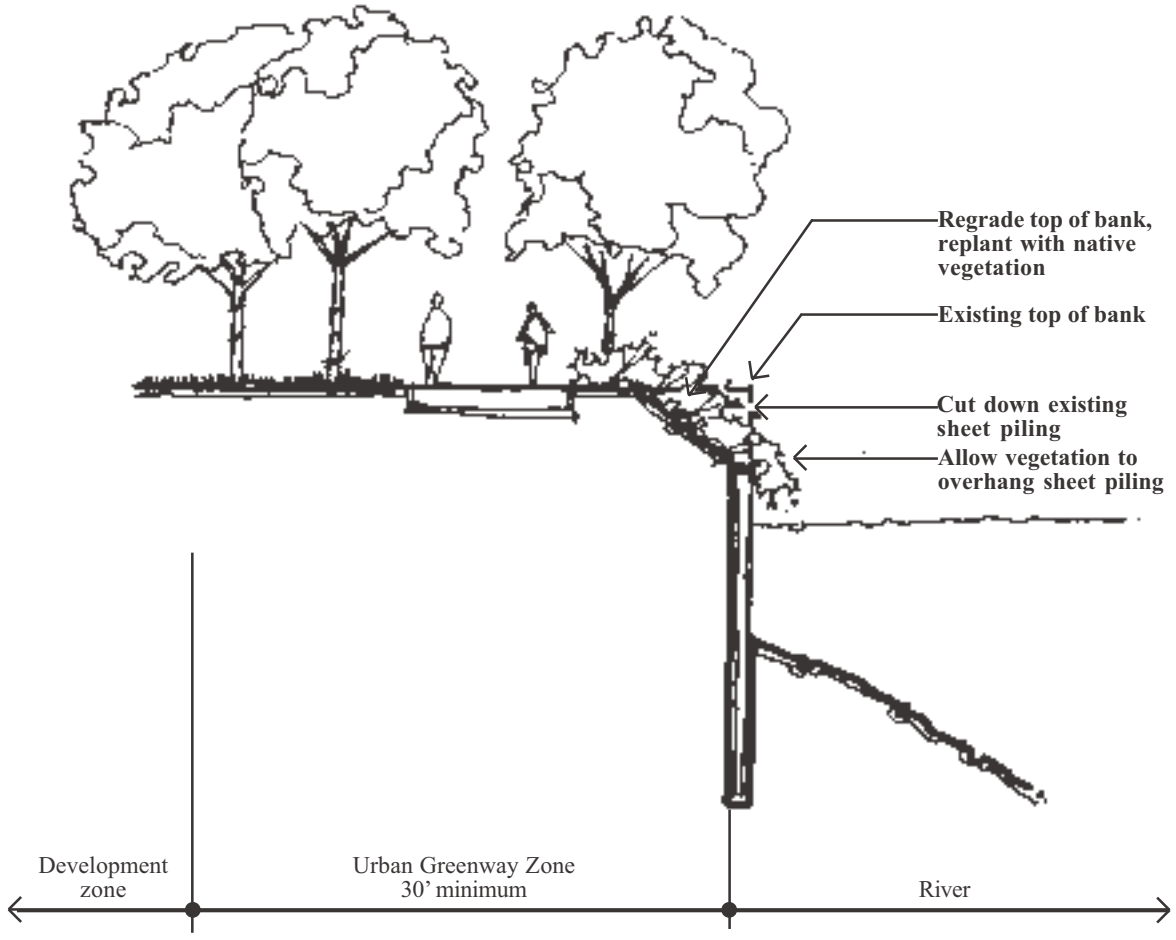
Inappropriate plants. Do not use plants that are "invasive" species which will dominate riverbank planting, "alien" species that are not consistent with native plants, high maintenance plants, or plants with little seasonal interest.

3.8 Bank Treatment (Bulkhead or Seawall)

Where the bank is a vertical structure such as bulkhead or seawall there is no riverbank zone per se. Planting at the top of the bulkhead or seawall may soften the appearance of these structures.

Railing. Provide a continuous safety railing for the length of the vertical bulkhead or seawall more than 30 inches above the mean water level. The railing should comply with all applicable building codes and other regulatory requirements.

Figure 3.9 Alternative edge treatment at a bulkhead.


Regrade top of bank, replant with native vegetation
Existing top of bank
Cut down existing sheet piling
Allow vegetation to overhang sheet piling
Development zone
Urban Greenway Zone 30' minimum
River

Ladder. Provide ladders attached to the face of the bulkhead to enable access for persons who may fall into the river to reach safety.

Life rings. Provide life rings in cabinets attached to poles or the railing near the bulkhead to provide emergency assistance for persons who may fall into the water.

Planting. Vines and shrubs that spill over the top of the bulkhead should be planted at the top of the bulkhead, where space and function permit, to soften the hard appearance of the bulkhead.

Seawall height. The finished height of new seawalls or bulkheads should be the mininum necessary above the high water mark, and must not exceed the height of seawalls or bulkheads located on adjacent properties.

3.9 River Dependent Uses

River dependent uses are those uses or activities that can be carried out only on, in, or adjacent to a waterway (see Appendix A for definition of river-dependent uses). Although the river dependent use may be located in the adjacent greenway zone and / or development zone, such uses will necessarily impact the riverbank zone.

Existing river dependent uses. Existing river dependent uses are appropriate uses that should remain.

New river dependent uses. New river dependent uses are appropriate uses that should be accommodated. Such new uses should, to the degree

Figure 3.10 Examples of river dependent use on the Chicago River.

possible, impact hte riverbank and urban greenway as little as possible and should accommodate an alignment for a potential multi-use trail.

Multi-use trail alignment. The alignment for a proposed or potential multi-use trail should be located on the land side of river dependent uses, rather than adjacent to the river, to avoid circulation, saftey, and security conflicts or other unacceptable conditions.

Landscaping and screening. Though there is no setback requirement for river dependent uses, landscaping and screening is required for portions of the river frontage not in active use for loading of off-loading materials.

Chapter Four: Urban Greenway Zone

4.1 Definition of Urban Greenway Zone

The urban greenway zone is the area between the top of bank or face of vertical bulkhead and the stback line or development zone.

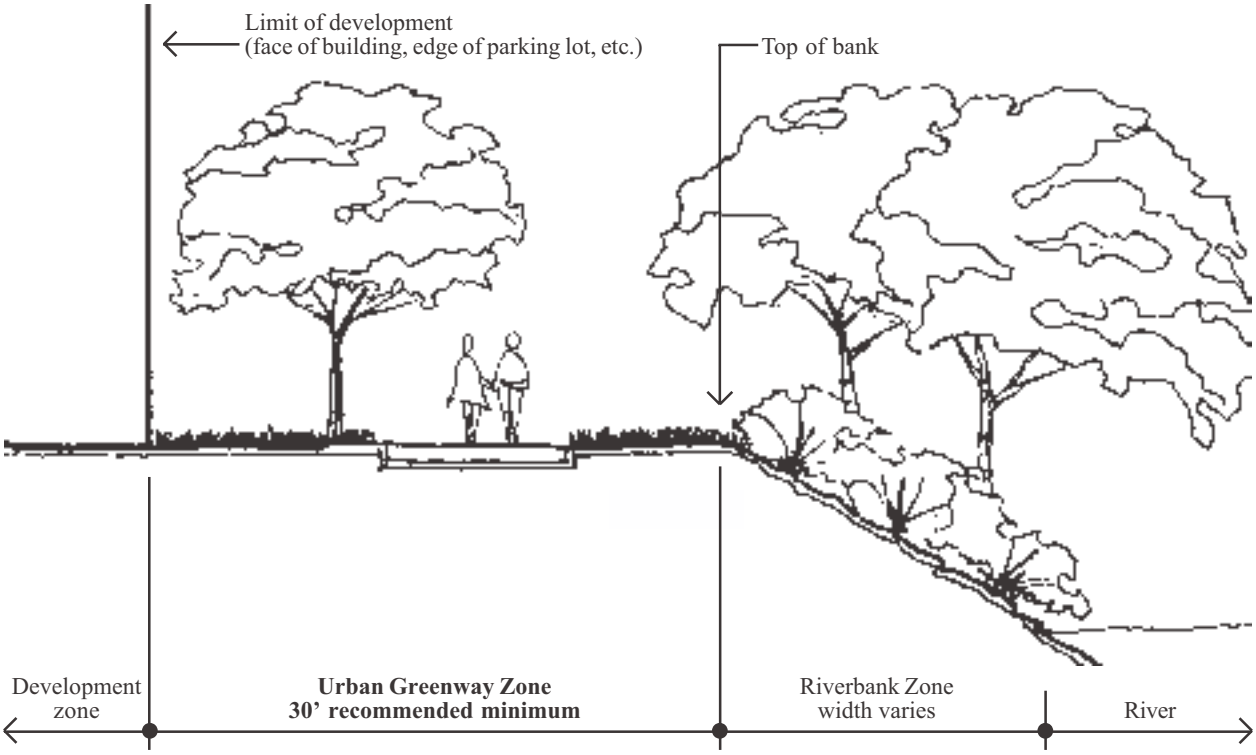


Figure 4.1 Typical riverbank section

4.2 Land - Based Recreational Uses

The urban greenway zone should be developed as a passive recreation linear park with a multi – use trail. In general, the urban greenway zone is too small to accommodate active, land - based recreational uses.

4.3 Water - Oriented Recreational Uses

Water - oriented recreational uses within the river corridor will often depend on access to facilities located within the urban greenway zone. Such uses include launching areas for human - powered craft (canoes, kayaks, rowboats, rowing shells, etc.), fishing docks or piers. Launch areas typically require gangways or ramps from the top of the bank down to river level floating docks or similar structures in the water, vehicular access to the launching area, and parking. Ancillary elements in the launching area may include lighting, signage, graphics, railings, fencing, seating, bicycle racks, trash receptacles, and landscaping. In addition to the launching

facility and ancillary elements, these uses should offer convenient access to toilets and public telephones.

Location of water – oriented recreational uses. Water – oriented recreational uses may be located in both the urban greenway zone and the riverbank zone.

Location of ancillary elements of water – oriented recreational uses. Ancillary elements should be located conveniently close to the launching area or other water access point, but preferably not located or placed in the riverbank that compromises the natural character of the river corridor.

Location of parking serving water – oriented recreational uses. Parking should never be located in the riverbank or urban greenway zones, but should be located at a convenient distance from the river.

4.4 Multi - Use Trail

The City proposes to establish a continuous multi - use trail throughout the river corridor to accommodate uses that include walking, jogging, running, bicycling, roller-skating, in-line skating, and skateboarding. The multi - use path should be signed and striped as required to minimize use conflicts (see Appendix G for trail design).

A key goal of the Chicago River Development Plan is to construct a continuous multi-use trail along the extent of the Chicago River.

Location: A multi - use trail along at least one side of the river is a key goal of the **Chicago River Corridor Development Plan**, and should be constructed in the urban greenway zone as recommended in the development plan. The alignment and design of the multi-use trail should minimize impacts to sensitive areas and habitats, such as wetlands and floodplain areas.

Design criteria: The multi – use trail, including underbridge connections, cantilevered walkways, floating boardwalks, etc., should be designed to meet all relevant and current codes, standards, and regulations. These should include, but not limited to, the Americans with Disabilities Act (ADA), American Association of State Highway and Transportation Officials (AASHTO) standards for multi - use trails, the Chicago Zoning Code, the Chicago Building Code, the **Guide to the Landscape Ordinance**, and any other relevant codes, standards, and ordinances.

4.5 Paving

Safe, affordable, and maintainable paving is an important and integral part of the multi - use trail, in order to minimize hazards, injuries, and liability, reduce capital expenditures, and keep maintenance costs under control.

Width: Recommended multi - use trail width is 10 feet. Minimum width is 8 feet. In areas with heavy use or multiple modes (e.g., walkers, bicyclists, and rollerbladers, etc.), a wider trail of either 12 or 14 feet is recommended.

The recommended path width of the riverwalk trail is 10 feet.

Striping: Pavement should be striped in accordance with AASHTO and other relevant standards.

Pavement design and materials: See Appendix C for more information on appropriate paving materials and pavement design.

4.6 Lighting

Attractive pedestrian - scale lighting is recommended to make the urban greenway safe and secure, and is an important and integral part of the multi - use trail. Lights should be spaced closely enough together that pools of light from adjacent light sources are easily seen by trail users (see Fig. 4.2).

Lighting levels: Adequate lighting for safety and security should be provided. The actual lighting level will vary according to the individual site and the existing ambient light levels from other sources.

Spacing: Regardless of the spacing dictated by lighting levels, lights should be spaced no further than 100 feet apart.

Luminaires and poles: See Appendix C for specific lighting information.

Figure 4.2 River edge lighting

4.7 Furnishings

Appropriate furnishings and fixtures should be provided throughout the length of the multi - use trail to make it attractive and functional for users (where furnishings are to be provided on a linear foot basis, fractions should be rounded off to the nearest whole number). Specific information regarding the following site furnishings is included in Appendix C.

Benches. Benches are to be placed along the multi - use trail to encourage public access and at points of scenic interest. Benches should be securely fastened to a concrete slab or footing. One bench should be provided for every 250 linear feet of river frontage.

Trash receptacles. In addition to trash receptacles at seating areas, one trash receptacle should be provided for every 250 linear feet of river frontage.

Bicycle racks. Bicycle racks should be provided at seating areas and at points where the multi - use trail intersects points of access to the street grid.

Drinking fountains. Drinking fountains should be universally accessible, of robust construction, designed for outdoor use, mounted securely to a concrete slab, and equipped with a drain inlet or catch basin within five feet of the drinking fountain. Drinking fountains should be provided at seating areas as noted below.

Figure 4.3 Bike rack

Figure 4.4 Seating area at Fullerton Plaza

4.8 Seating Areas

Where appropriate, seating areas are encouraged along the multi - use trail, in addition to the individual benches and other site furnishings (see Fig. 4.4).

Location. One seating area should be provided for every 500 linear feet of river frontage.

Seating area. Each seating area should provide a minumum of two benches, one trash receptacle, and one bicycle rack (see "Furnishings" above). Drinking fountains are required in seating areas where the overall river frontage of the parcel is greater than 1,000 feet.

4.9 Signage

Directional, informational, identity, and regulatory signage and graphics are useful and necessary components of the multi - use trail. The City of Chicago has developed a riverwalk identity program that includes signage and graphic standards. For more specific signage information, see Appendix D.

The City of Chicago has developed signage standards to be used throughout the river corridor.

Directional and regulatory signage. Provide directional and regulatory signage where the multi - use trail intersects with streets or other trails and where there are regulatory requirements (e.g., "stop," "yield," etc., or as dictated by AASHTO standards).

Interpretive signage: Provide informational signage at points of historic or other interest.

Identity signage. Identity signage should be provided where the multi-use trail intersects with streets or other public access points. The signage should state the riverwalk is open to the public during defined hours (typically normal Park District hours).

4.10 Underbridge Connections

Bridges and their abutments are often barriers to continuous riverside access along the Chicago River. Underbridge connections should be built where space beneath the bridge deck permits, so that the multi - use trail can run continuously adjacent to the riverbank.

Underbridge connections provide safe continuous well-lit passage through bridges and heavy street arterials.

Responsibility. Responsibility for construction of the multi - use trail underbridge connection may be the City of Chicago, the adjacent property owner / developer, or shared between them. Cost sharing will be determined during the planned development review process.

Alignment. Properties adjacent to potential underbridge connections should be designed not to compromise or eliminate access to develop the multi-use trail connection. The alignment of the multi - use trail to and through the underbridge connection should avoid blind corners, tight radii, and steep slopes that present safety and security problems.

Width. Width should be per AASHTO standards and as indicated above under “Multi – use Trail.”

Paving. Paving of the underbridge connection in the public right - of - way should be poured - in - place concrete with a light or medium broom finish, per “Multi - Use Trail Paving” above. Asphalt is not an acceptable material, due to the dark color and consequent poor visibility under the bridge.

Lighting. Underbridge connections should be illuminated with fixtures mounted to bridge abutments or piers. Illumination levels should be designed and maintained at 3.0 footcandles.

Railing. Provide a continuous safety railing, including a minimum of 20 feet on the approaches to the underbridge connection from the multi - use trail. Such a railing should comply with all applicable building code and other regulatory requirements. In the absence of more restrictive requirements, see Appendix 3 for specific information on railing articulation.

4.11 Cantilevered Walkways

Buildings that have been built to the water’s edge, as well as bridges and their abutments are often barriers to continuous riverside access along the Chicago River. Where the multi - use trail cannot be built on land within the greenway zone,

and where a detour around such an obstruction on the land side would be so long or indirect as to discourage use of the multi - use trail or effectively interrupt it, construction of a cantilevered walkway around the building or bridge should be considered to maintain a continuous multi - use trail adjacent to the riverbank.

Design guidelines. Design specifications for cantilevered walkways should be consistent with the requirements for "Underbridge Connections." The deck material consist of poured-in-place concrete or treated heavy duty timber decking, with joints aligned perpendicular to the direction of travel on the trail.

4.12 Floating Walkways or Walkways Built over Water

Buildings, that have been built to the water's edge, as well as bridges and their abutments, are often barriers to continuous riverside access along the Chicago River. Where the multi - use trail cannot be built on land within the greenway zone or on a cantilevered walkway over water, and where a detour around such an obstruction on the land side would be so long or indirect as to discourage use of the multi - use trail, construction of a floating walkway around the building or bridge should be considered.

Floating boardwalks present opportunities to bring the public closer to the water's edge and extend the continuity of the riverwalk around difficult development conditions.

Design expertice: Floating walkways should be designed by an experienced marina designer working with a landscape architect and / or civil engineer or other experienced trail designer.to ensure that the design is safe, and secure.

Design guidelines. Design specifications for cantilevered walkways should be consistent with the requirements for "Underbridge Connections." The deck material consist of poured-in-place concrete or treated heavy duty timber decking, with joints aligned perpendicular to the direction of travel on the trail.

4.13 Water Features

Water features, including but not limited to fountains or cascading waterfalls, are encouraged architectural design elements which reflect the natural elements of the Chicago River.

Water features and nature trails present excellent opportunities to reflect the natural elements of the Chicago River.

4.14 Nature Trails

Nature trails are appropriate in the greenway zone where there are natural areas that merit access and / or interpretation. Bird houses/feeders and bat boxes are encouraged near these trails to attract wildlife.

Figure 4.5 Nature Trail

Nature trail location. Nature trails should not be the main trail, but secondary trails separated from the principal multi - use trail.

Nature trail surface. Nature trails should have a "soft" surface (e.g., wood chips or gravel), little or no lighting, and interpretive or informational signage.

4.15 Other Improvements

Other public are appropriate within and adjacent to the greenway zone provided they do not preclude the future development of a multi - use trail along the river.

4.16 Access Points, Street Ends, and Overlooks

Access to the river and the water's edge can be as important as development of continuous access along the river. Particularly where land ownership and development conditions do not easily permit public access along the river, it is important that access be provided to the river. Access points may developed where streets stop at the river.

Access points may be developed with a number of features, including but not limited to cul - de - sacs or turnarounds to remove vehicles from close proximity to the river; vehicular barriers which could be planters or highway type barriers to prevent vehicles from driving into the river; seating areas with benches, trash receptacles, bicycle racks, and other site furnishings; lighting, for ambiance, safety, and security; landscaping; and access by steps and / or ramps to the water's edge.

Access points: Develop access points to the river wherever possible, but especially where there is no public access along, or adjacent to, the river and where street rights - of - way stop at the river.

Overlook development: Develop overlooks at access points and street ends. Overlooks may include cul - de - sacs or turnarounds, vehicular barriers, seating areas with benches, trash receptacles, bicycle racks, and other site furnishings such as lighting, landscaping, and steps and / or ramps to the water's edge.

4.17 Riverside Cafes and Restaurants

Seating for riverside cafes and restaurants are encouraged within the development zone provided that it does not block public access to the multi-use trail or privatize or restrict use on the river greenway zone.

River Cafes provide new dining opportunities for residents and visitors as well as promote public appreciation for the Chicago River.

4.18 Landscaping

The greenway zone should be heavily and attractively landscaped with particular attention to screening through industrial, commercial, and residential areas. Plantings should respond to these conditions by aligning in more formal rows, grids, or bosques in or near the downtown area where space is limited and architectural influences suggest a more formal arrangement. Where the greenway zone passes through informal areas, trees and other plantings should be arranged informally with and whenever possible native plants should be selected.

Tree locations: Locate trees in informal groupings where the greenway zone and the river corridor have a more naturalistic, informal character. Align trees in more formal rows, grids, or bosques in or near the downtown where space is more limited and the architectural influences suggest a more formal arrangement.

Vine locations: Plant vines at the base of all blank buildings walls, retaining walls, bridge abutments, or other structures that have little inherent architectural interest.

The use of low mow wildflower and prairie mix is recommended on the riverbank and urban greenway zone.

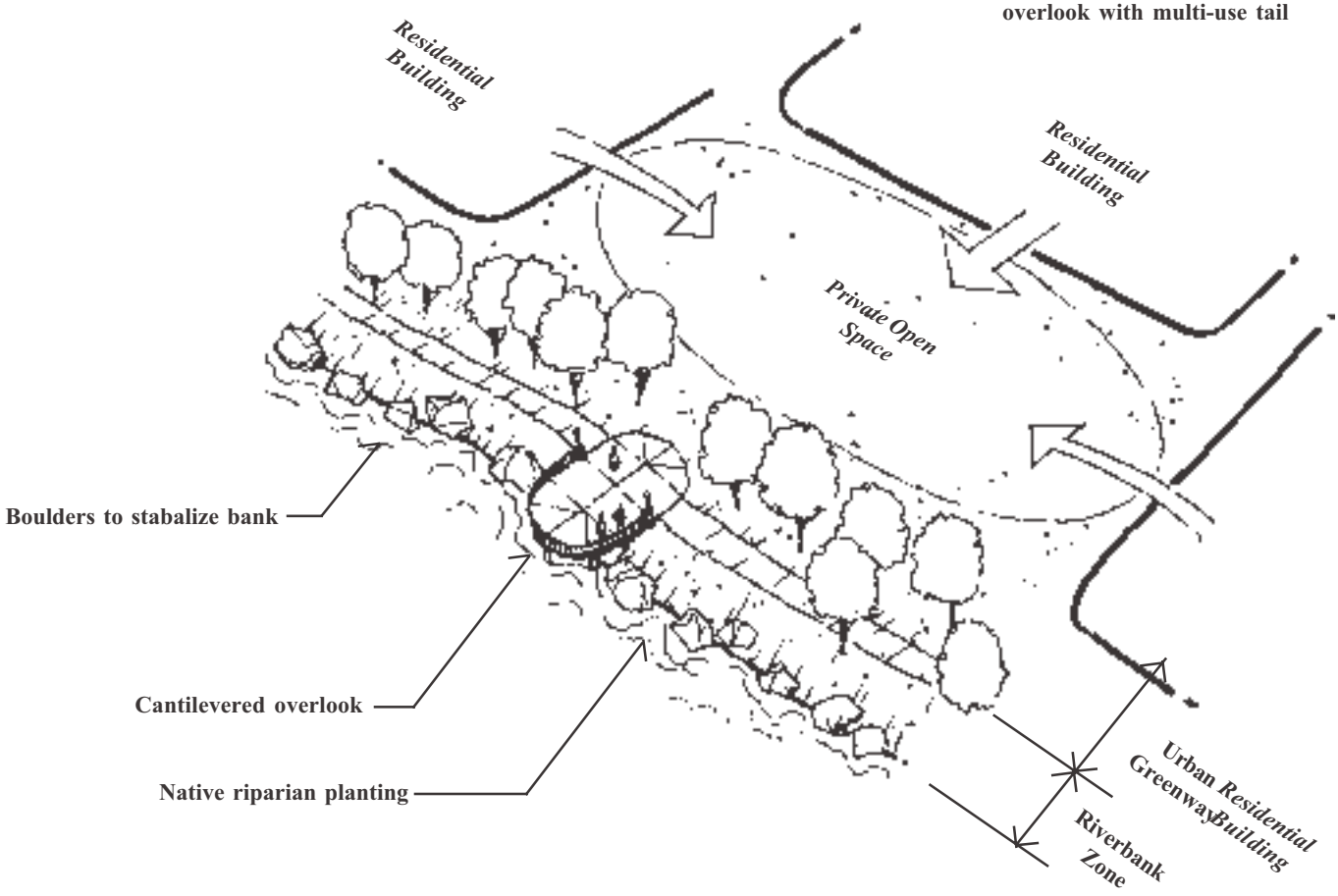
Shrub, groundcover, and perennial bed locations: Plant shrub, groundcover, and perennial beds throughout the greenway zone, to provide landscape interest near the ground and alongside the multi - use trail. To the extent possible, native wildflower and low mow grasses are encouraged for wildlife habitat enhancement and reduced maintenance responsibilities.

Plant species: See Appendix 8 for a detailed list of recommended plant species.

4.19 Public Art

Public art: Public art, including, but not limited to sculpture, mosaic and tile panels, water features and environmental artwork are encouraged within, or adjacent to, the greenway zone.

Figure 4.6 Cantilevered overlook with multi-use tail



Chapter Five: Development Zone

5.1 Definition of Development Zone

The development zone is the area adjacent to the Chicago River corridor that does not fall within the urban greenway / setback zone or the riverbank zone, and that may be developed or redeveloped with new or existing structures for private use as permitted by zoning.

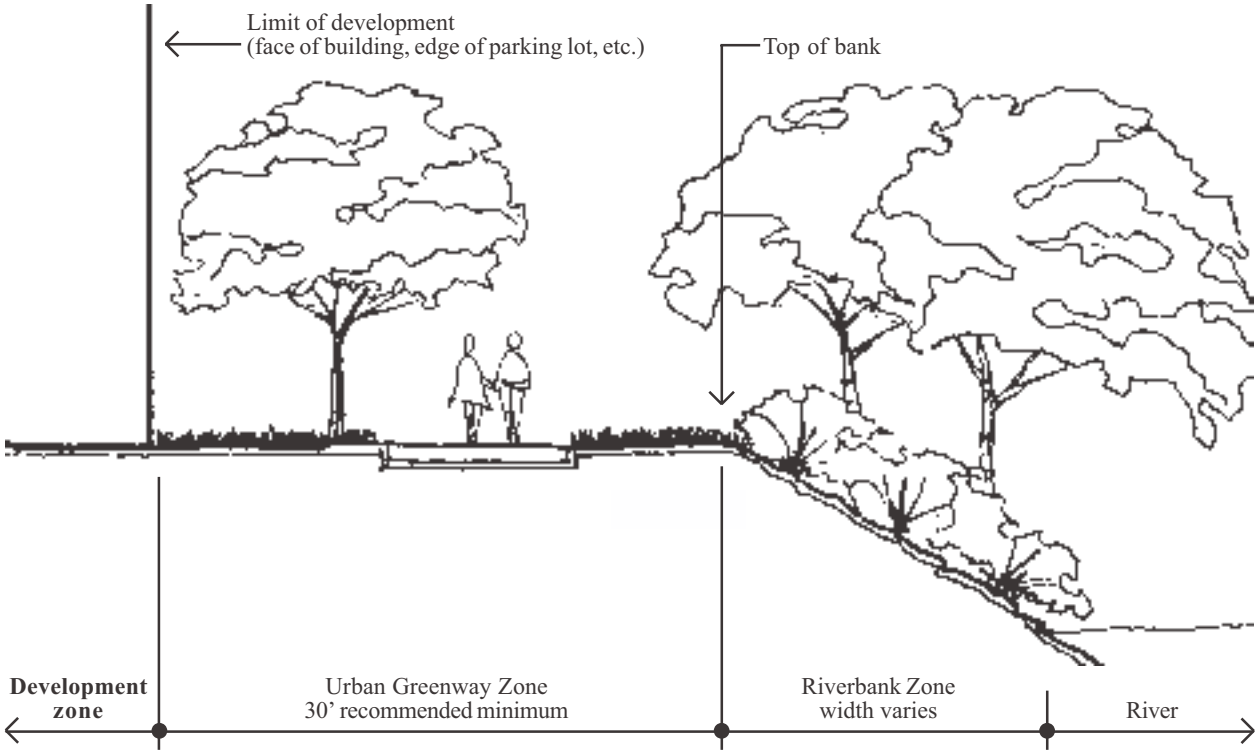


Figure 5.1 Typical riverbank section

5.2 Design, Orientation and Massing of New Structures and Buildings

The river elevation of any riverside building should be treated architecturally as one of its principal facades.

Building design: The river facade of buildings should be designed as a principal or major facade, and should have at least the same design elements, articulation, relief, and other architectural considerations as the other facades.

Building materials: The materials on the river facade of buildings should be of at least the same quality as the materials on the other facades.

Orientation. New structures and buildings should be oriented to the river, and not turn their back on the river, so that the greenway zone and

Figure 5.2 New buildings should be orientated to the river to create a safe and lively riverfront.

riverbank zone are not perceived only as the area behind the structure or building. Entrances and windows on the river side will generate pedestrian circulation and activity in the greenway zone, which will make it more active, safe, and secure.

Massing. It is equally important that the massing of new structures and buildings be sensitive to the river and the greenway zone, so that the river and greenway zone are not overwhelmed by tall and dense structures and buildings built to the setback line.

5.3 Renovation of Existing Buildings

It is equally important the adaptive re-use of existing buildings and structures on the river oriented to the river so that the greenway zone and riverbank zone are not perceived only as the area behind the structure or building. The design principles in the previous section for the "Design, Orientation and Massing of New Structures" apply.

5.4 Screening of Parking Lots and Vehicular Use Areas

Parking lots and vehicular use areas should be attractively landscaped such that the view from the river and greenway zone is a green, attractive one. These areas should meet the landscape requirements of the City of Chicago Zoning Ordinance Chapter 17-11 Landscape and Screening Requirements and the City of Chicago's **Guide to the Chicago Landscape Ordinance.**

Landscape Screen Requirements for:	Vehicular Use Areas	Non-Vehicular Use Areas
Fence	4ft ornamental metal fence, but not placed within river setback area. >6ft ornamental metal security fence requires approval of Zoning Administrator.	4ft ornamental metal fence is permitted, but not placed within river setback area.
Tree	2 per 25 linear feet of river frontage. Placement of trees is riverside of fence, and may be placed in natural layout.	1 per 25 linear feet of river frontage. Placement of trees is river side of fence, and may be placed in natural layout
Hedge	Continuous hedge 3ft on center spacing. Placement of hedge is river side of fence.	Not required.
Foundation Plantings	Not applicable.	Foundation plantings are required in front of building.

Figure 5.3 Riverfront screening requirements

Screening: In addition to the standard requirement of one (1) tree per 25 linear feet of river frontage within the river setback area, parking lots and vehicular use areas, per the Landscape Ordinance, require its own separate perimeter screening requirement of one (1) shade tree per 25 linear feet and a continuous hedge which must be maintained between thirty (30) inches and forty - eight (48) inches in height (see Fig. 5.3).

5.5 Screening of Storage Areas

Outdoor storage areas, should be screened from view from the river and greenway zone.

Outdoor storage area screening. Screen walls or fences of high quality durable materials are required for outdoor storage areas. Acceptable materials include poured-in-place concrete, split face or ground face concrete masonry units, and heavy wood. The height of the screen shall not exceed eight (8) feet.

Appropriate screening is required to maintain an aesthetically pleasing river front.

Unacceptable materials. Unacceptable materials for screening include chain - link fencing, plastic slat inserts, and lightweight lattice wood panels.

Landscaping of screening walls and fences. Screening walls and fences should be planted with vines at the base, and the vines should be trained up and over the walls and fences to soften their appearance and increase the amount of landscaping visible from the river and greenway zone.

5.6 Lighting

Lighting in the development zone should be adequate and appropriate for safety and security, and well as an attractive feature of the project site.

Appropriate lighting is required to provide for a safety and security, as well as attractive landscape elements to the development zone.

Lighting levels. Provide lighting with an adequate light level for project safety (visibility, adequate and safe illumination of vehicular use areas, etc.) and security (visibility, continuous illumination of vehicular use and other areas, avoidance of dark or unilluminated areas, etc.).

Light fixture and luminaire style. Light fixtures and luminaires should be attractive, pedestrian scale fixtures with articulated bases, poles, pole tops, and luminaires.

Light fixture height. Recommended light fixture height is less than twenty (20) foot; maximum light fixture height is thirty (30) feet.

Light pattern. Luminaires should be equipped with shields so that light does not shine into adjacent residential or institutional areas.

Chapter Six: Bubbly Creek Development Guidelines

The development of the South Fork of the South Branch of the Chicago River traces back to the 1860s and the origins of the Chicago Union Stock Yards, which occupied the area bounded by Pershing Road, Halsted Street, 47th Street and Ashland Avenue.

Five hundred thousand gallons of fresh water were pumped daily from the Chicago River into the yards, and vast quantities of untreated waste was dumped into the waterway. Bubbly Creek became a notorious open sewer, its name derived from the bubbles caused by decaying matter which filled the river bottom..

Upton Sinclair wrote about the deplorable conditions of the Chicago Union Stock Yards in his novel, *"The Jungle"* (1906). He described Bubbly Creek as if ..."grease and chemicals that are poured into it undergo all sorts of strange transformations, which are the cause of its name; it is constantly in motion, as if huge fish were feeding in it, or great leviathans disporting themselves in its depths. Bubbles of carbonic acid gas will rise

Figure 6.1 Historic Chicago Union Stockyards

Figure 6.2 Bubbly Creek today with the Racine Avenue Pump Station in background

to the surface and burst, and make rings two or three feet wide. Here and there the grease and filth have caked solid, and the creek looks like a bed of lava; chickens walk about on it, feeding, and many times an unwary stranger has started to stroll across, and vanished temporarily."

Bubbly Creek still effervesces today. At its southern terminus lies the Metropolitan Water Reclamation District's Racine Avenue Pump Station, the largest facility of its kind in the United States. Fourteen pumps drain a 30 square miles area discharging stormwater into the river during heavy storm events. The remainder of the time Bubbly Creek is stagnant.

Over time, stormwater management practices (BMPs) can significantly improve the water quality of Bubbly Creek. These BMPs include new parks, open spaces, greenways, green roofs, cisterns, swales, wetlands,

Figure 6.3 Racine Avenue Pump Station Sewershed 30 sq mile Service Area

and other improvements in public and private developments. Within this sewershed, all new developments are responsible for reducing their stormwater contribution.

6.1 Purpose of Setback for Bubbly Creek

Special measures are necessary at Bubbly Creek to mitigate the degraded conditions of the waterway and its banks. A wider setback is needed.to rebuild the riverbank in a manner that provides protection from sedimentation, erosion, and runoff.

Existing riverbanks along Bubbly Creeek are fairly steep (steeper than 3H:1V), high (greater than 10ft), eroded, and unstable. In many cases the original timber retaining wall has failed. These banks are susceptible to waterline erosion, sloughing and gullying, particularly if there are heavy weight loads located near the top of the bank.

The expanded setback provides the physical space to rebuild dilapidated banks in a sustainable manner for the purpose of stormwater management, stabilizing riverbanks, water quality improvements, and providing appropriate naturalistic landscaping and public access. Other benefits include improved wildlife and fish habitat, pollutant removal, runoff attenuation, and streamside aesthetics.

6.2 Bubbly Creek Boundary

Bubbly Creek extends south from the South Turning Basin of the South Branch of the Chicago River to its terminus at the MWRD Racine Avenue Pump Station. The boundaries approximate 27th Street on the north to 39th Street on the south (see Fig. 6.4).

Bubbly Creek extends from 27th Street to 39th Street.

6.3 Setback Requirements

All new developments on Bubbly Creek are required to setback sixty (60) feet from the existing top of bank as established by survey at the time of planned development application.

> **Exceptions to the Setback Requirement.** Exceptions to the setback requirement include existing structures or buildings that are located within the setback zone and river dependent industrial uses that require barge access

Figure 6.4 Map of Bubbly Creek and area affected by 60ft river setback

Setbacks on Bubbly Creek shall accommodate (1) riverbank improvements, (2) stormwater best management practices, (3) public riverwalk trail, and (4) landscape buffer/screening.

6.4 Guidelines for the Repair of Slopes.

Excessively steep slopes are required to be repaired and re-contoured to a minimum 3H:1V slope (see Fig. 6.5). The slope shall be planted with native vegetation, and stabilized with an erosion control fabric or geotextile reinforcement system. Terracing, soil wraps, and other bioengineered solutions are other options that can be used to treat steeper slopes.

Toe of Bank Stabilization. The toe of the bank is the point where the riverbank meets the water, and may need to be reinforced with rip rap, coir biologs, and live staking to control water line erosion and scour from fluctuating water levels.

Tree Survey. A tree inventory of all trees larger than 8 inches in diameter at breast height will be required.

Removal of Trees. Recontouring of the bank may entail the removal of significant number of trees. Care should be taken to preserve the healthiest and largest trees, particularly trees located at the toe of the bank.

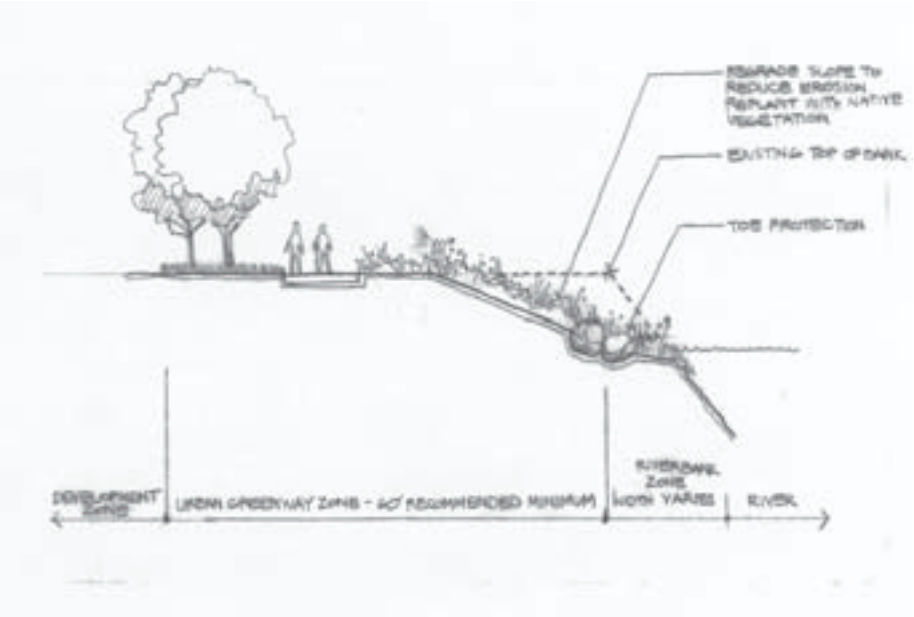


Figure 6.5 Recommended treatment of 60' river setback for an existing slope condition.

6.5 Guidelines for Repair or Modification of Seawalls

The construction of new seawalls or bulkheads is discouraged on Bubbly Creek. If a new seawall or bulkhead is necessary, the height of the new seawall shall be low as possible, but above the high water mark, and limited to the height of the seawall on adjacent properties.

Seawalls shall be lowered to the extent possible, but not below the existing tie back anchorage system, to accommodate a sloped natural vegetated embankment between the development site grade and the top of the modified seawall. The slope of this embankment shall not exceed 3H:1V (see Fig. 6.6)

Additionally, the top of the seawall shall be covered with overhanging native vines or vegetation.

6.6 Stormwater Management Requirements

Central to improving the environmental quality of Bubbly Creek is the integration of above ground stormwater BMPs. To the extent possible the river setback should manage as much of the stormwater from the development site before diverting stormwater into the sewer system or waterway.

> **Pupose.** Stormwater best management practices, such as vegetated bioswales, infiltration strips and level spreaders, will attenuate water flow and improve water quality.

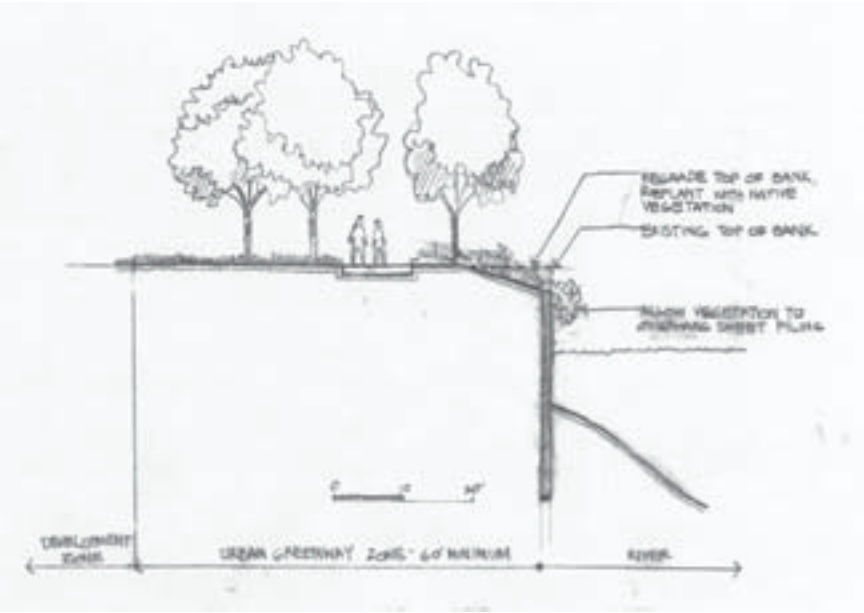


Figure 6.6 Recommended treatment of 60' river setback for an existing bulkhead condition.

Swales with native grass vegetation are nearly twice as effective as pavement in reducing velocity and flow. The slower the flow, the more effective the swale will be to assimilate nutrients before they reach the water body.

Design. The stormwater management plan extends beyond the river setback and should be integrated into the entire development site to include design elements such as parkway swales, grading, pumps, rain gardens, green roofs, permeable pavements, and ponding on roadways. Conveyance to the river setback is accomplished through a sewer pipe connection or swale. Underdrains are recommended as base for permeable pavements if underlying soil is not sand.

Avoid designing linear swale systems characteristic along highways. The design should be more fluid, sinuous, and naturalistic, and does not necessarily have to be designed as one continuous swale, but a network of swales connected by culverts. The design should also provide opportunity for public education and interpretation.

Design guidelines for stormwater BMPs are located Appendix L.

Figure 6.7 Example of riverfront industrial site utilizing riverbank recontouring, infiltration area, and porous pavers for stormwater management.

Size and Release Rate Requirements. Below are BMP sizing specifications that meet the target 80% total suspended solids reduction. Alternative sizing methodologies, in leiu of, or in addition to the ones below, may be specified by the Department of Water Management or Department of Environment.

For volume based BMPs (infiltration basins, rain gardens, permeable pavers) - BMPs should be sized to capture and retain the first flush volume, defined as the first one inch of precipitation.

For flow based BMPs (swales, filter strips) - BMPs should be sized to treat the first flush storm, defined as the two year, one hour storm based on the City's standardprecipitation data used in stormwater calculations (TP-40). First flush flow velocity should be kept to less than one feet per second with a minimum BMP residence time of nine minutes to allow for adequate settling of particulates. The 100 year flow velocity should also be evaluated to ensure it does not cause scour to the riverbank.

BMPs should be designed and sized to meet the target 80% total suspended solids reduction.

For ponds and stormwater wetlands - Release rates should be no greater than 0.04 cfs/acre for the two year, 24 hour storm event based on the City's TP-40 rain data.

Construction of a single BMP large enough to meet the water quality requirement may not always be possible. Therefore, a combination of BMPs in series ("treatment train") may be used. Landscaping. Stormwater bioswales shall be planted with native

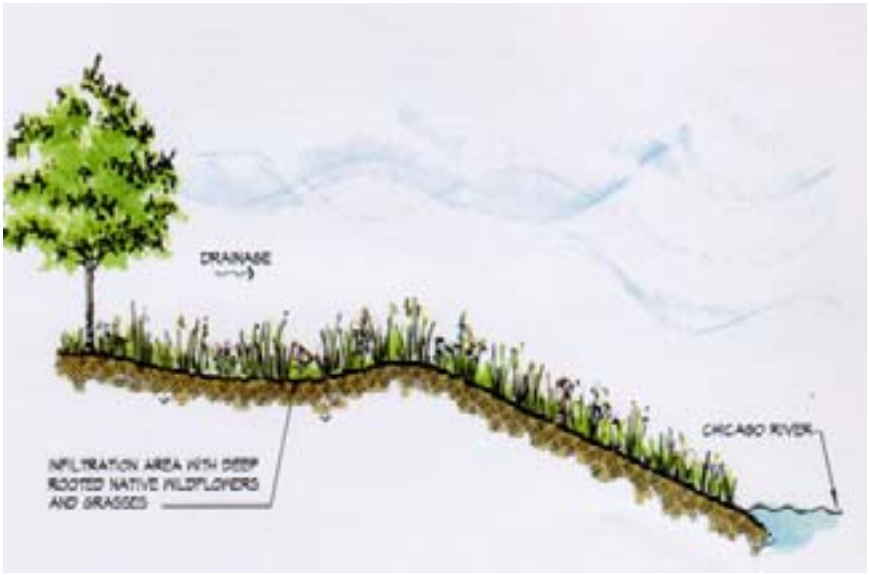


Figure 6.8 Example of stormwater infiltration area along the river

wet prairie mix, predominated by native grasses at least 8 inches in height. Taller prairie grasses are more effective attenuating flow and capturing pollutants than turf grass.

Maintenance. Once the vegetation is established, stormwater BMPs require very little maintenance. Mowing or prescribed burning may be done once every two to three years to remove the dead organic accummulated material (see Appendix 10). Stormwater BMPs need to be kept free of obstructions and debris which may impede flow.

6.7 Landscape Buffer and Riverwalk Multi-Use Trail

Private uses outside the 60ft river setback need to be appropriately screened by landscaping. Apart from the specifications outlined in Chapter 5, the following apply:

Riverwalk trail. The placement of the riverwalk trail shall not be located on the riverbank nor on top of stormwater swales or infiltration areas as to impede the flow of water. Boardwalks are a solution to locate a path on top of a stormwater bmp without interfering with the function of the bmp.

Landscape design. The intent is that the entire 60 foot setback be planted with native vegetation. Trees and shrubs should be located in naturalistic layered groupings.

The placement of landscape screening should be sensitive to the placement of stormwater BMPs so as to not impede its capacity to convey or infiltrate stormwater.

Fencing. To create a naturalistic aesthetic, fencing is discouraged on the riverwalk trail, with the exception for saftey purposes where the trail approaches the riverbank.

6.8 Development Zone Requirements

The development zone for Bubbly Creek is the area outside the 60 foot set-back zone, that may be developed or redeveloped with new or existing structures for residential, commercial, and manufacturing uses as allowed by zoning. Chapter Five Development Zone specifications apply.

Figure 6. 9 Example of landscaped buffer adjacent to riverwalk trail

APPENDIX A: DEFINITIONS

AASHTO standards: industry standards for the multi-use path established by the American Association of State Highway and Transportation Officials in its Guide For the Development of Bicycle Facilities.

Angle of Repose: the maximum slope at which unconsolidated earth, gravel or similar material will remain at rest, i.e. the angle that naturally forms when loose material is dumped into a pile. With respect to the riverbank, the angle of repose means the steepest angle not subject to erosion. The minimum angle of repose along the Chicago River or new natural slopes is 3H:1V.

Applicant: the person or entity submitting a planned development application.

Bioswale: is a shallow depression created in the earth to accept and convey stormwater runoff. The bioswale uses natural means, including vegetation and soil, to treat stormwater by filtering out contaminants being conveyed in the water.

BMP: practice or type of control to keep pollutants and debris from being washed into the sewer system or waterway.

Chicago Landscape Ordinance: the portion of Titles 10 and 17 of the Municipal Code of Chicago pertaining to landscaping, as detailed in the Guide to the Chicago Landscape Ordinance.

Chicago River: includes the following waterways

Main Branch of the Chicago River
North Branch of the Chicago River
North Branch Canal (east side of Goose Island)
North Shore Channel
South Branch of the Chicago River
Sanitary and Ship Canal
South Fork of the South Branch of the Chicago River ("Bubbly Creek")
Associated slips and inlets along the South Branch and Sanitary and Ship Canal

Deep Tunnel: a system of tunnels and reserviors operated by the MWRD intended to control flooding and water pollution in the Chicago Metropolitan area. Formally knows as the Tunnel and Reservoir Project (TARP).

Design Guidelines and Standards: the present document of the Chicago River Corridor Design Guidelines and Standards.

Dock : any structure extending or elevated over the water from the riverbank for the purpose of berthing a boat.

Development zone: the private use area "outside" of the urban greenway zone or river setback area.

Federal Navigation Channel: the federal authorized portion of the river open to commercial navigation. Includes the Main Branch, South Branch, portion of Bubbly Creek north

of 31st Street, Sanitary and Ship Canal, and the portion of the North Branch south of Addison Street.

Infiltration Filter Strip: are vegetated areas intended to treat stormwater sheet flow from adjacent impervious areas. Filter strips function by slowing down runoff velocities, filtering out sediment and other pollutants, and provide infiltration to underlying soils.

Floor Area Bonus: the right to build a larger building in return for providing a public amenity. The Chicago Zoning Ordinance provides floor area bonuses for additional river setback area in the downtown zoning districts.

Mooring: a location where a boat may be tied up or anchored for a period of time, which may or may not include a dock for loading and unloading.

MWRD: the Metropolitan Water Reclamation District of Greater Chicago, the public agency responsible for sewerage treatment and flood control in the Chicago Metropolitan area.

Park District hours: hours during which outdoor Chicago Park District facilities are open to the public, typically from 6:00 am to 11:00pm every day.

Planned development: a real estate parcel in the city of Chicago developed in accordance with the planned development provisions of the Chicago Zoning Ordinance (Municpal Code, Chapter 17-8).

Planned development ordinance: an amendment to the Chicago Zoning Ordinance governing a particular planned development. Planned developments are negotiated by the Chicago Department of Planning and Development, and approved by the Chicago Plan Commission and the Chicago City Council.

Public access easement: a legal instrument by which a riverside property owner conveys to a public entity or other entity the right to permit public access.

Public accessible: open to the public free of charge during park district hours.

Riparian zone: plantings that closely approximate that of a natural river edge, consisting of native plant species to serve as wildlife habitat.

Riverbank zone: the area adjacent to the river between the water's edge and the top of bank (where there is a bank). Where there is a vertical bulkhead or other engineered vertical structure, there is no riverbank zone. See the "Setbacks" section for a definition of the water's edge and the "top of bank."

River Dependent Uses: those uses or activities that can be carried out only on, in, or adjacent to a waterway because the use requires access to the waterway and which, therefore, cannot be located inland, including:

- Bulk material operations that ship or receive materials by barge
- Marinas
- Recreational and commercial boating facilities

- Waterfront dock and port facilities
- Navigation aids, basins, and channels
- Bridge abutments
- Recreational parks and open spaces
- Other uses that require waterborne transportation or the river as a source of water

River Plan: Chicago River Corridor Development Plan, as adopted by the Chicago Plan Commission.

Riverwalk trail (multi-use path): continuous paved riverside shared use path intended for multiple recreation uses, including but not limited to walking, jogging, bicycling, and in-line skating. Motorized use of the trail is not permited except by emergency vehicles.

Setback Zone: also called the urban greenway zone, extends from the top of bank to the development zone. Setbacks are used to regulate and direct development to preserve or achieve a public good or benefit.

Setback variances: are permitted in the setback to accomodate irregular and constrained development sites. Variances require mitigation ration of 2.5:1 of additional open space adjacent to the.setback area.

Toe of bank: the area where the sloped riverbank meets the water line.

Top of bank (sloped bank): the point at the top of the slope at the water's edge where the steepness of the slope becomes less than ten (10) percent.

Top of bank (vertical bulkhead): the point at the top of the bulkhead where a line between other analogous points is located continuously over land and does not cross over the water.

Urban greenway zone: the area between the top of bank or face of vertical bulkhead and the setback line furthest from the river and top of bank.

Water's edge: the high water level for a particular site or reach of the river.

Appendix B: Development Areas

Two Development Areas Along the Chicago River

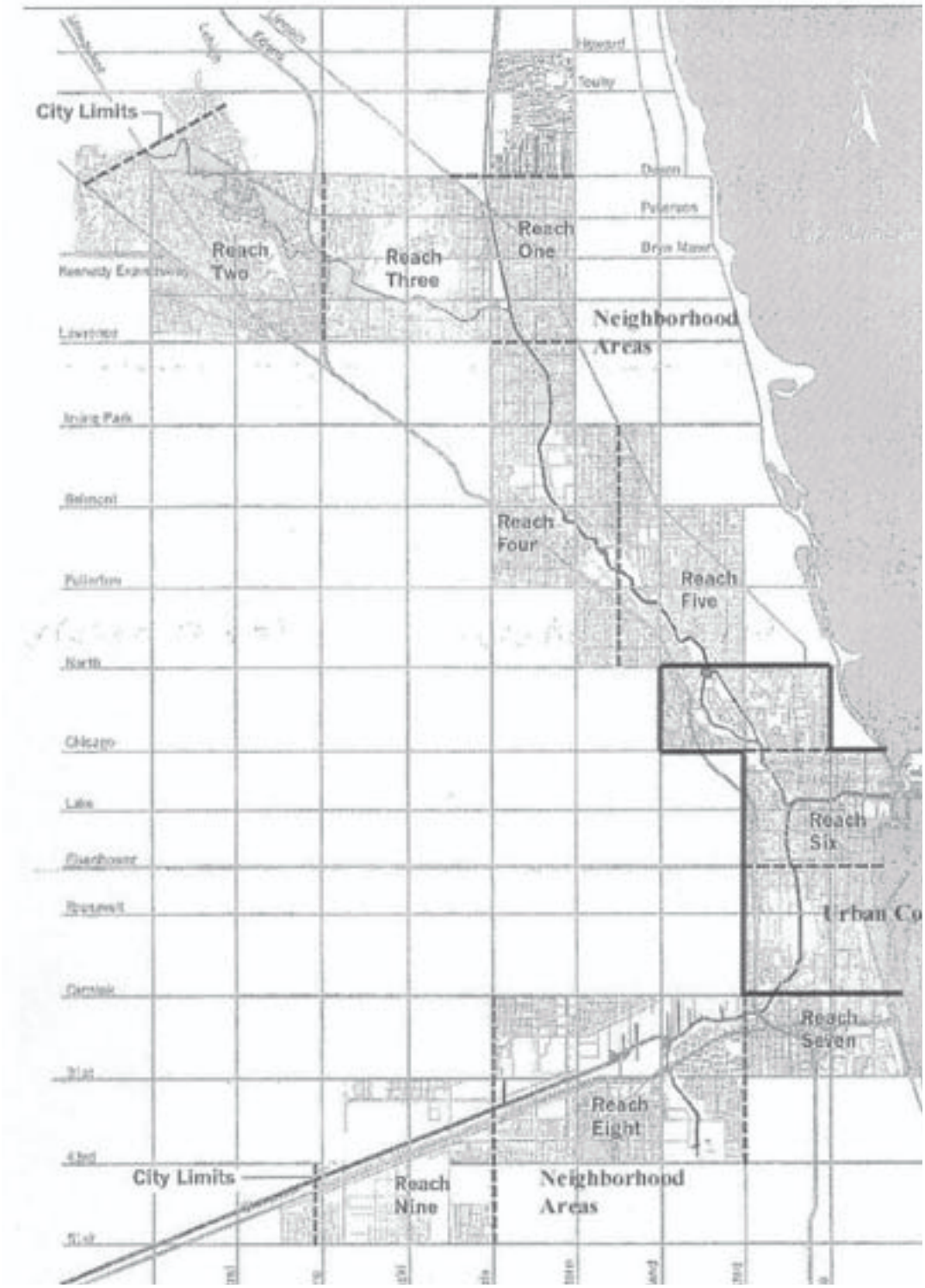
The character of the areas adjacent to the Chicago River differs depending whether the area is located within the urban core or within a residential neighborhood. The riverfront areas in the urban core are generally formal in appearance and dominated by architectural elements. The riverfront areas located in the residential neighborhoods are generally informal in appearance and are more likely to be dominated by vegetation.

Therefore, where appropriate, different site elements for areas depend upon whether they are located in the urban core or the residential neighborhoods.

Urban Core: This area is defined by North Avenue (north), Ashland Street (west), Cermak Street (south), and Lake Michigan (east).

Neighborhoods: The remainder of river sites not contained within the urban core are categorized as neighborhood sites. These sites are north of North Avenue, west of Ashland Street, south of Cermak to the city limits.

Location of Urban Core and Neighborhood Areas
Relative to the Nine Reaches of the Chicago River Corridor Development Plan



Appendix C: Site Furnishings

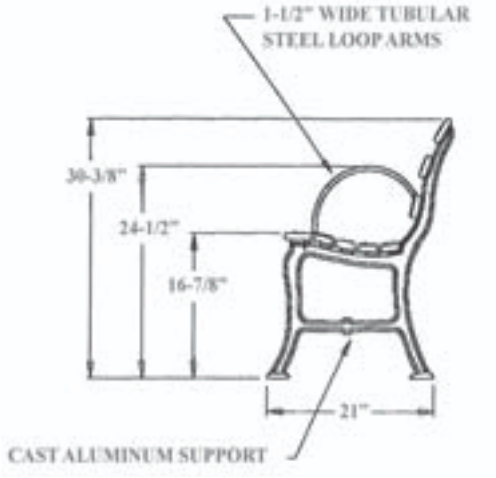
Bench

All benches should be 8 feet long with a center armrest. The vertical distance from the top of the center armrest to the top of the sitting area must not exceed 12". If the vertical distance from the top of the center armrest to the top of the sitting area exceeds 12" then intermediate armrests must be added every two feet. Benches should be powder coated with welded steel construction and must be securely fastened to a concrete slab or footing.

Product:	8 foot ornamental iron bench with center armrest
Application:	Urban Core and Neighborhood Areas
Manufacturer:	Du Mor or supplier of equivalent product
Product #:	Bench 93
Color:	Black
Contact:	NuToys Leisure Products, Box 2121, LaGrange, Illinois 60525, 1-800-526-6197

Bench Alternate for Private Developments

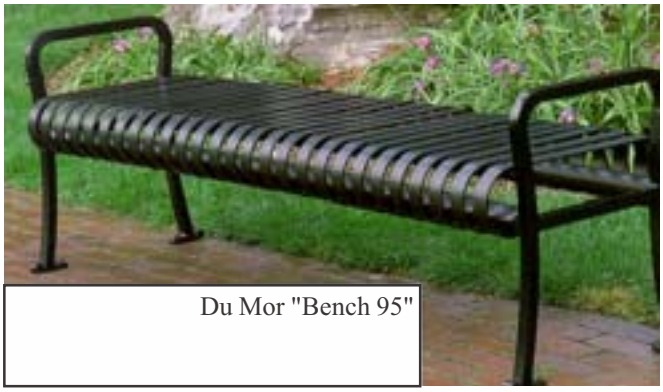
Product:	8 foot wood bench with arms and center armrest added
Application:	Urban Core and Neighborhood Areas
Manufacturer:	Landscape Forms or supplier of equivalent product
Product Model:	Chicago
Color of Frame:	Black
Contact:	Landscape Forms, 835 West Webster, Chicago, Illinois 60614, 1-800-255-0341



Backless Bench

Backless benches are appropriate seating at river outlooks. All backless benches should not exceed 4 feet in length. Benches should be powder coated with welded steel construction and must be securely fastened to a concrete slab or footing.

Product:	4 foot ornamental iron backless bench
Application:	Urban Core and Neighborhood Areas
Manufacturer:	Du Mor or supplier of equivalent product
Product Model:	Bench 95, Model 46
Color:	Black
Contact:	NuToys Leisure Products, Box 2121, LaGrange, Illinois 60525, 1-800-526-6197



Du Mor "Bench 95"

Ribbon Bicycle Rack

Bicycle racks should be of the continuous ëribboní style, powder coated welded steel construction, capable of securing a minimum of four bicycles. Bicycle racks should be securely fastened to a concrete slab or footing.

Ribbon Bicycle Rack:

2 Humps -	Model #:600-5A
3 Humps -	Model #:600-7A
Application:	Urban Core and Neighborhood Areas
Manufacturer:	Tubular Forms or supplier of equivalent product
Color:	Black
Contact:	Kay Park Recreation, P.O. Box 477, Janesville, Iowa 50647, 1-800-553-2476

Accessible drinking fountain

Universally accessible drinking fountains should be securely mounted to a concrete slab and should be located within five feet of a drain inlet or catch basin.

Accessible Drinking

Product:	Dual Bowl Accessible Drinking Fountain
Application:	Urban Core and Neighborhood Areas
Manufacturer:	Most Dependable Fountain or supplier of equivalent product
Product #:	440
Color:	Black
Contact:	Most Dependable Fountains, 4697 Winchester Road, Memphis, Tennessee 38118, 1-800-552-6331

TRASH RECEPTACLE

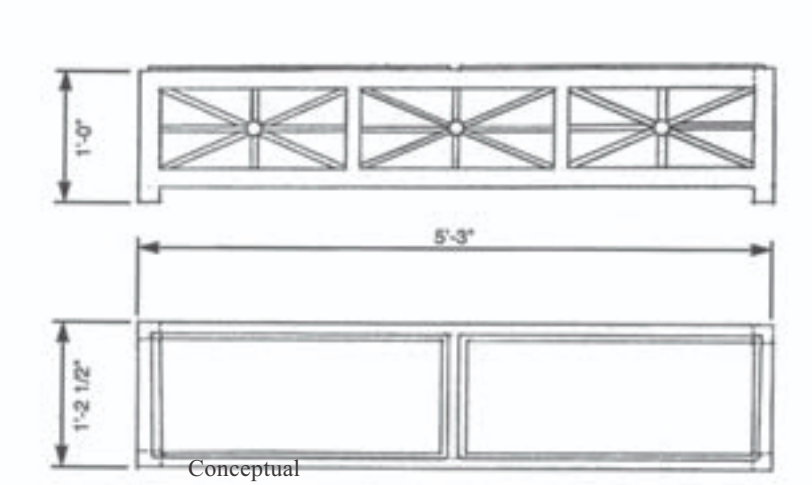
Trash receptacle should be securely attached to concrete paving.

Product:	Bethesda 32 Gallon Capacity with spun steel lid
Application:	Urban Core and Neighborhood Areas
Manufacturer:	Victor Stanley or supplier of equivalent product
Product #:	S42
Color:	Black
Contact:	Howard L. White & Associates, Inc. P.O. Box 95642, Hoffman Estates, Illinois 60195, 1-800-225-2880

Flower Box

Flower boxes are composed of two parts: a metal bracket and removable plastic containers for planting.

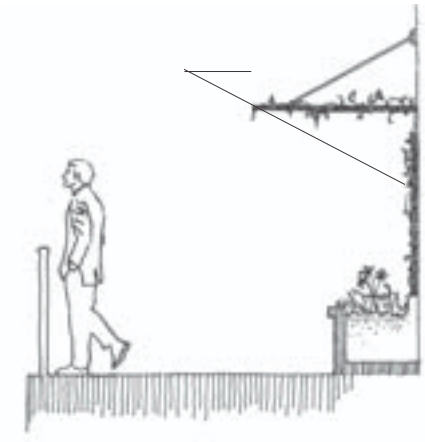
Product: Flower	Box with welded bracket supports
Manufacturer:	G.F. Structures or supplier of equivalent product
Color:	Black
Contact:	G.F. Structures, Chicago, Illinois, 773-626-4122



Conceptual

Vine Supports

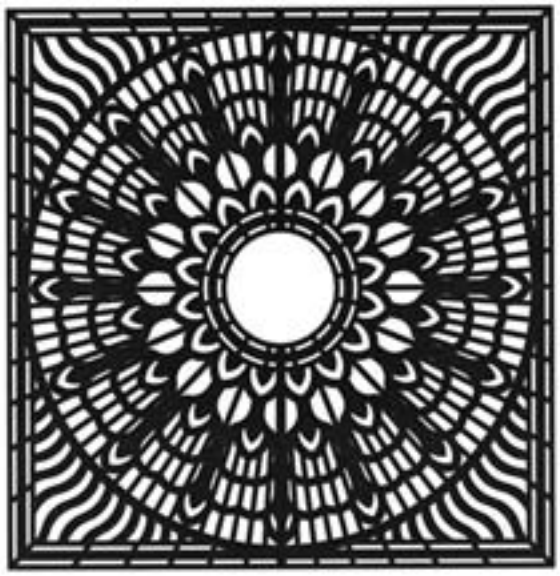
Vine supports are encouraged along the river as a method by which to introduce foliage on unattractive vertical surfaces. Vine supports may be secured directly against the vertical plane or may project from the vertical plane to create an overhead canopy. Vine supports must not impede pedestrian movement along the riverwalk and must be securely fastened.



Tree Grates

Tree grates selected for use along the riverwalk should be ADA compliant. Therefore, grate openings must be no greater than a half inch wide in one direction. Tree grates should be oriented so that the primary pedestrian movement is perpendicular to grate openings. Recognize that grate openings must be of sufficient size to accommodate tree growth over time.

Product: 5’ X 5’ Tree grate, 3/4” thickness
Application: Urban Core and Neighborhood Areas
Color: Black

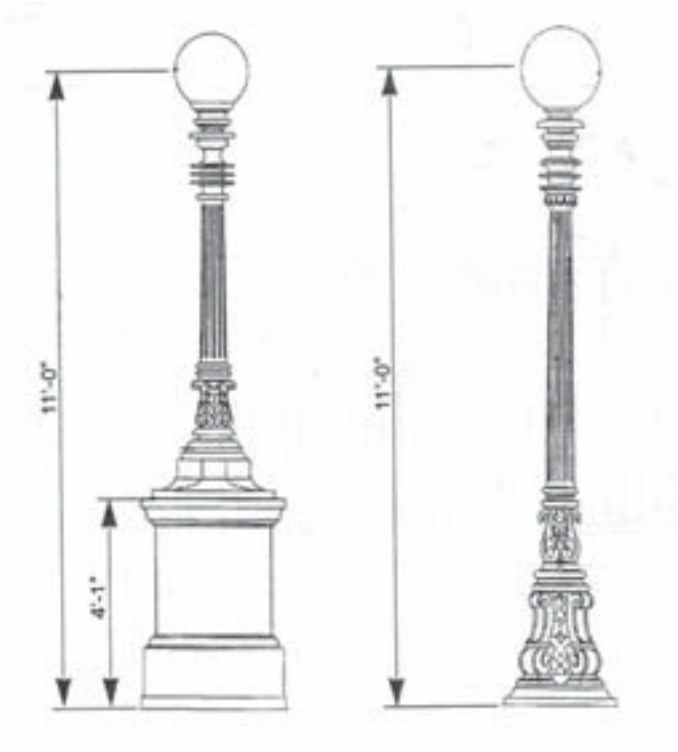


Tree Grate

WACKER DRIVE LIGHT

In the urban core where the Wacker Drive railing style applies (the area defined by Chicago Avenue on the north, Harrison Street on the south and Lake Michigan on the east), the Wacker Drive railing light fixtures must be used. In this same area, lighting fixtures away from the railing must conform with the Wacker Drive light fixture.

Product:	Wacker Drive Railing Light Fixture and Wacker Drive Light Fixture
Manufacturer:	Robinson Iron, Alexander City, Alabama or supplier of equivalent product
Contact:	Building Blocks, Inc., Chicago, IL 312-243-9960

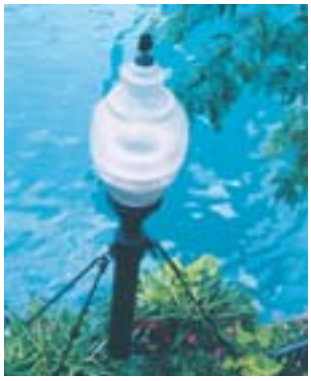


Wacker Drive Railing Light

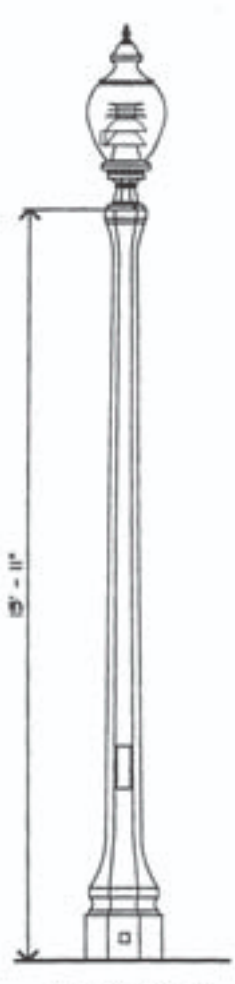
Wacker Drive Light

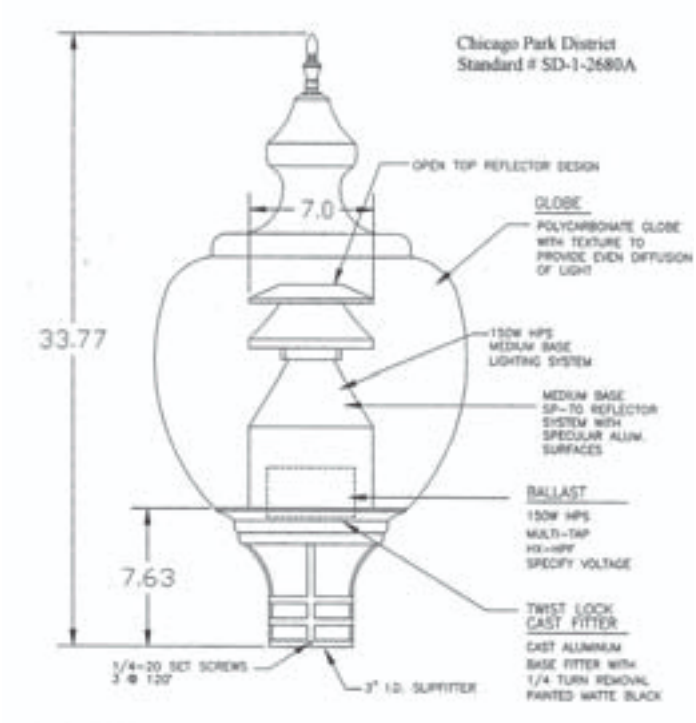
Urban Core and Neighborhood Area Lights

Light fixtures in areas of the urban core and neighborhood areas outside of the defined Wacker Drive area must use specified acorn fixture on the pre-cast concrete pole



Product:	Bureau of Electricity standard acorn fixture with acrylic lens, 150 watt, high pressure sodium
Application:	Urban Core and Neighborhood Areas
Manufacturer:	Hadco #S5855 or equivalent
Poles:	Light poles should be precast concrete mounted on a concrete footing
Manufacturer:	StressCrete #KT14, Color: Salt and Pepper S-30, Base Plate Mounting, Bureau of Electricity standard





Tree Uplighting

Tree uplighting creates a dramatic effect. Bullet lights or floodlights may be located at the base of the tree and shields on the fixtures direct the light upward. Frequently, along the riverwalk in the urban core, lights are located at the base of the tree canopy projecting light upward. Generally, two uplights per tree are recommended to maximize the depth and texture of the projected light. If uplights are to be located in the tree canopy, it is recommended that the cords be neatly concealed along the tree trunk in a 1/2 inch diameter black PVC conduit. Direct burial of electrical line is preferable to stringing line above grade. In Chicago, where corrosion is an issue, composite non-metallic fixtures are preferable.

Step Light

Step lamps may be used for illuminating stairs or ramps.

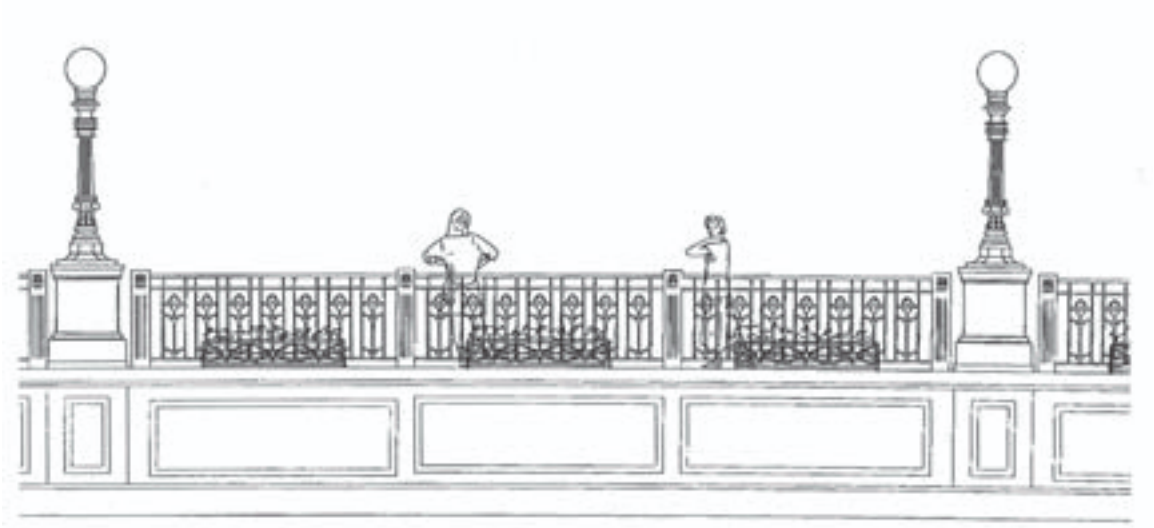
Product:	Brushed Stainless Steel Step Light
Application:	Urban Core and Neighborhood Areas
Manufacturer:	Bega or supplier of equivalent product
Product Model#:	2915P -CPC housing
Remarks:	Provide integral electronic ballast with 0 degree F starting temperature
Contact:	Morr-Sharp Associates, 20 East Jackson Blvd. Chicago, IL 60604, 312-986-1515

Railings

In Neighborhood Areas, the maintenance of a natural riverbank is encouraged whenever possible and should be modified to accommodate a railing only when dangerous conditions exist. When a seawall exists, railings are required if the mean water level is more than 30 inches below the surface elevation of an adjacent walkway. All railings must comply with the City of Chicago's Building Code.

Wacker Drive Railing

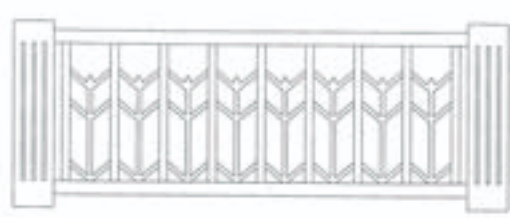
The Wacker Drive railing style applies to all riverwalk railing in the area defined by Chicago Avenue on the north, Harrison Street on the south and Lake Michigan on the east. This railing standard is currently being developed by the Chicago Department of Transportation.



Wacker Drive Railing Conceptual Design

Urban Core beyond Wacker Drive Railing

The Urban Core beyond Wacker Drive railing style applies to all riverwalk railing in two areas. The first area is defined by the North Avenue Turning Basin on the north to Chicago Avenue on the south. The second area is defined by Harrison Street on the north and Cermak Street on the south. This railing standard is currently being developed by the Chicago Department of Transportation

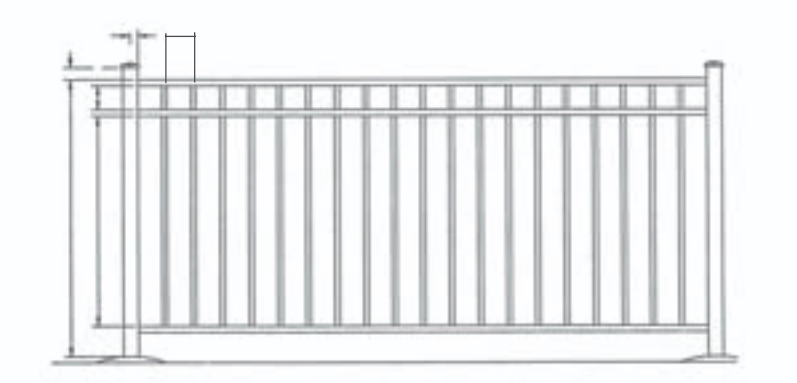


Urban Core Railing

Neighborhood Railing

All areas beyond the urban core that require railing must satisfy the following criteria:

a) the railing must be 42 inches in height
b) the top horizontal rail must be a minimum of 2 inches wide
c) the distance from the top horizontal rail to the second horizontal rail must be 4 inches
d) pickets must not extend below the bottom horizontal rail
e) railing posts must have smooth caps
f) 3/4 inch railing pickets must be spaced no farther than 4 inches on center
g) railing posts shall be solid bar stock
h) the railing must be black
i) railing design must comply with all building and safety codes



Paving and Surfacing

In the Urban Greenway Zone, paving should be a hard, smooth impermeable surface, either asphalt or poured-in-place concrete. Gravel should be avoided for safety and accessibility reasons. Materials with joints and the potential for differential settling, such as precast concrete or brick pavers, should also be avoided.

Pavement design: Multi-use trail paving design should vary according to soil and subsurface conditions. In no case should an asphalt multi-use trail be less than 3 inches of asphalt (1 1/2 inches binder course and 1 1/2 inches of surface course) over 9 inches of compacted aggregate base on a compacted subgrade. In no case should a concrete multi-use trail be less than 5 inches of concrete over 6 inches of compacted aggregate base on a compacted subgrade.

The following paving and aggregate surfaces are suggested for use in the Development Zone, and should comply with Illinois Department of Transportation Standards and Specifications for Road and Bridge Construction, including AFTM standards:

Asphaltic Concrete Paving

Cast-in-Place Concrete

Expansion Joints and Contraction Joints

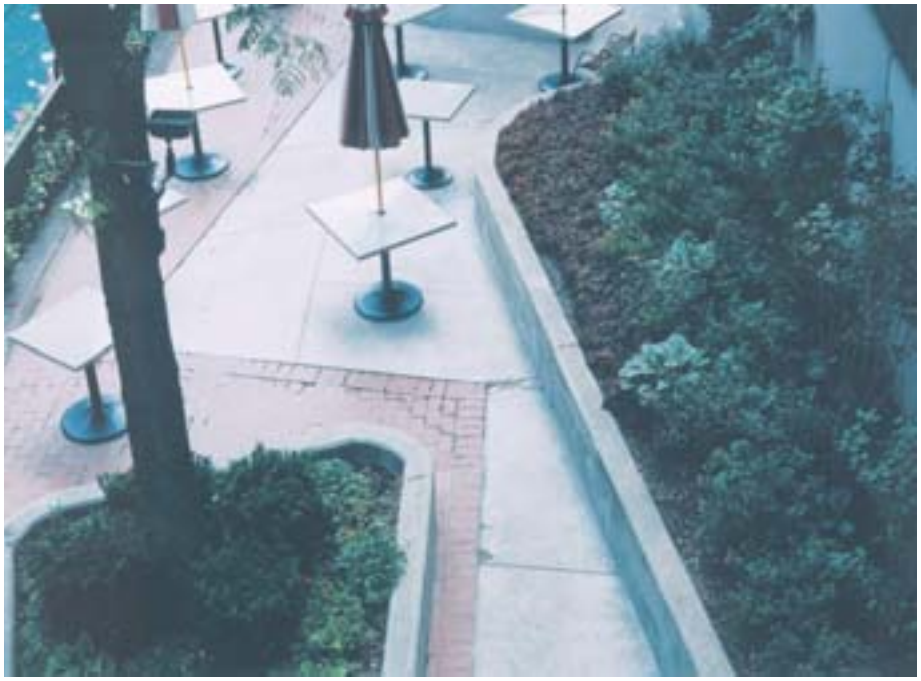
Unit Paving

Decomposed Granite

Limestone Screening

Architectural Concrete Structures

Architectural concrete structures such as planter walls and curbs, stairways, and light pole footing frequently occur along the river particularly in the urban core. Weep holes are typically needed in any rigid wall construction to relieve pressure due to infiltration and are placed 4 - 6 inches above grade and spaced 3 - 10 feet apart depending on soil porosity. Granular soils require less frequent spacing while clay soils require frequent spacing of weep holes. A batter (slight vertical sloping of the wall face toward the retained side) of 12:1 is typically recommended for rigid walls with relatively smooth surfaces. Tops of walls should typically slope 2% toward the retained side to prevent staining. (See Section 5 of the Illinois Department of Transportation Standard Specifications for Road and Bridge Construction, including AFTM standards)



Appendix D: Signage

Identification Signage

All identification signage within the urban core is to be consistent in color, font, and spatial arrangement with the black and gold signs attached to the bridges. All text should be gold on a black background, with a fine gold line near the sign's perimeter.

The Riverwalk emblem should be incorperated in identification signage along the main branch.

Park Signage

In the parklands of neighborhood areas, identification signage should be consistent with the Chicago Park District Signage Standards currently being developed. Standard Park District Signage is manufactured by: Western Industries, Inc., 3501 South Cicero Avenue, Chicago, Illinois 60804. Signage Contact at Western Industries is John Beckman at 708-656-0900.

The Eastland Disaster was the second largest marine disaster after the sinking of the Titanic. This interpretative sign along the Chicago River marks the location of the disaster.

Interpretative Signage

The river is a biological system as well as a significant cultural element within Chicago. Efforts to create informative signage that interpret the river's importance to the city's heritage are strongly encouraged. Signage that includes not only text but maps and illustrations is desirable.

The sign at Mariano Park describes the shelter's architectural significance.

Appendix E: Plant Palettes

The Chicago Landscape Ordinance should be consulted prior to undertaking any landscape related work along the Chicago River. This document specifies the appropriate soil mixtures, acidity, and organic content.

9.1 Recommended Plant Palette for Riverbank Zone

This list is derived from the Native Plant Guide for Streams and Stormwater Facilities in Northeastern Illinois and Restoring and Managing Stream Greenways. Suggested plant species are intended to provide land owners, planners, and developers with an understanding of the diversity of native plants found along natural stream corridors in this area. Selection of species should also consider local environmental conditions, such as soils and hydrology. The recommended native plant palette represents only a limited number of plant species, emphasizing those species that should be relatively easy to establish in river bank restoration projects.

Trees and shrubs which provide edible fruit for wildlife are indicated with an asterisk (*)

Lower Bank (Stream Stabilization)

Trees

Salix nigra	Black Willow

Shrubs

Cephalanthus occidentalis	Common Buttonbush
Salix amygdaloides	Peachleaf Willow
Sambucus canadensis	Elderberry*

Forbs/Grasses/Aquatic plants

Acorus calamus	Sweet Flag
Alisma subcordatum	Water Plantain
Carex vulpinoidea	Fox Sedge
Eleocharis acicularis	Creeping Spike Rush
Eleocharis obtusa	Blunt Spike Rush
Elymus canadensis	Nodding Wild Rye
Elymus virginicus	Virginia Wild Rye
Eupatorium maculatum	Spotted Joe Pye Weed
Glyceria striata	Fowl Mana Grass
Helenium autumnale	Common Sneezeweed
Leersia oryzoides	Rice Cut Grass
Lobelia cardinalis	Cardinal Flower
Panicum virgatum	Switch Grass
Scripus americanus	Chairmakerís Rush
Solidago gigantia	Late Goldenrod
Spartina pectinata	Prairie Cordgrass
Verbena hastata	Blue Vervain

Upper Bank and Riparian Zone

Trees

Betula nigra	River Birch*
Celtis occidentalis	Hackberry*
Juglans nigra	Black Walnut *
Populus deltoides	Cottonwood (male)
Quercus bicolor	Swamp White Oak*
Quercus macrocarpa	Bur Oak*
Quercus palustris	Pin Oak*

Shrubs

Cornus racemosa	Gray Dogwood*
Cornus stolonifera	Red-Osier Dogwood*
Corylus americana	Hazelnut*
Viburnum dentatum lucidum	Arrow-Wood Viburnum*
Viburnum lentago	Nannyberry*

Forbs/Grasses/Aquatic plants

Andropogon gerardi	Big Bluestem
Aster laevis	Smooth Blue Star
Aster lanceolatus	Panicled Aster
Aster novae-angliae	New England Aster
Bouteloua curtipendula	Side-Oats Grama
Chelone glabra	Turtlehead
Coreopsis tripteris	Tall Coreopsis
Filipendula rubra	Queen of the Prairie
Elymus canadensis	Nodding Wild Rye
Elymus virinianum	Virginia Wild Rye
Monarda fistulosa	Wild Bergamot
Panicum virgatum	Switch Grass
Petalostemum purpureum	Purple Prairie Clover
Pycanthemum virginianum	Common Mountain Mint
Ratabida pinnata	Yellow Coneflower
Rudbeckia hirta	Black Eye Susan
Silphium laciniatum	Compass Plant
Silphium terebinthinaceum	Prairie Dock
Solidago rigida	Stiff Goldenrod
Sorgastrum nutans	Indian Grass
Spartina pectinata	Prairie Cord Grass
Tradescantia ohioensis	Spiderwort
Veronia fasciculata	Common Ironweed
Veronicastrum virginicum	Culver's Root

Recommended Plant Palette for Urban Greenway Zone

The following list identifies native species and horticultural varieties and cultivars of native species with the designation. Ornamental non native species less appropriate to the naturalized areas and parks yet well suited to an urban setting are designated "U.S.". Native species and their cultivars may also be selected for the developed areas. "Native"as used in this document desribes plants indigenous to the area within one hundred miles of Chicago.

Large Deciduous (Shade) Tree

U.S.	Acer ginnala	Amur Maple
N.	Acer x freemanii varieties	Autumn Blaze Maples
N.	Acer rubrum vaarieties	October Glory and Red Sunset Maples
N.	Acer saccharinum	Silver Maple
N.	Betula nigra	River Birch
N.	Celtis occidentalis	Hackberry*
N.	Gleditsia triacanthos inermis varieties	Skyline, Shademaster, and other thornless Honeylocusts
N.	Quercus bicolor	Swamp White Oak*
N.	Tilia americana	American Linden
U.S.	Tilia americana 'Redmond'	Redmond Linden
U.S.	Tilia x euchlora	Crimean Linden
U.S.	Tilia tomentosum 'Sterling Silver'	Sterling Silver Linden

Small Deciduous (Ornamental) Trees

N.	Amelanchier canadensis	Shadblow Serviceberry*
N.	Amelanchier x grandiflora	Apple Serviceberry*
N.	Amelancheir laevis	Allegheny serviceberry*
U.S.	Carpinus Betulus	European Hornbeam
N.	Carpinus caroliniana	Blue Beech and Musclewood
N.	Cercis canadensis	Redbud
N.	Cornus alternifolia	Pagoda Dogwood*
N.	Cornus mas	Cornelian Cherry Dogwood*
N.	Crataegus crusgalli	Cockspur Hawthorn*
N.	Crataegus crusgalli inermis	Thornless Cockspur Hawthron*
N.	Crataegus mollis	Downy Hawthorn*
N.	Crataegus phaenopyrum	Washington Hawthorn*
N.	Crataegus punctata	Dotted Hawthorn*
N.	Crataegus viridis	Winter King Hawthorn*
U.S.	Malus varieties	Adams, Siberian, Jackii Siberian, Bob White,Beverly,Donald Wyman, Prairiefire, Profusion, Red Jewel, Sargent, Snowdrift, Red Zumi, and Yellow Zumi Crabapple
N.	Ostrya virginiana	Ironwood

Deciduous Coniferous Trees

U.S.	Larix decidua	European Larch
N.	Larix laricina	American Larch
U.S.	Taxodium distichum	Bald Cypress

Evergreen/Coniferous Trees

U.S.	Picea abies	Norway Spruce
U.S.	Pinus flexilis	Lumber Pine
U.S.	Pinus mugo	Mugo Pine
U.S.	Pinus nigra	Austrian Pine
N.	Pinus stobus	White Pine
U.S.	Pseudotsuga menziesii	Douglas Fir

Deciduous Shrubs

N.	Aronia arbutifolia	Red Chokeberry*
N.	Aronia melanocarpa	Black Chokeberry*
U.S.	Berberis thunbergii varieties	Japanese Barberry
U.S.	Buddleia davidii	Butterfly Bush
U.S.	Chaenomeles japonica	Japanese Flowering Quince
N.	Cornus sericea (stolonifera)	Redtwig Dogwood*
N.	Cornus sericea (stolonifera) 'Bailey's'	Bailey's Redtwig Dogwood*
N.	Cornus sericea (stolonifera) 'Isanti'	Istanti Redtwig Dogwood*
U.S.	Cotoneaster spp.	Peking, Cranberry, Hesse, Rock Spray and Multiflorus Cotoneaster
U.S.	Diervilla sessilifolia	South Bush Honeysuckle
U.S.	Forsythia intermedia hybirds	Forsythia
U.S.	Forsythia viridissima	Bronx Forythia
U.S.	Forthergilla gardenii	Drawf Bottlebrush, Drawf Fothergilla
N.	Hydrangea arborescens	Smooth Hydrangea
U.S.	Hydrangea paniculata varieties	Peegee Improved and Tardiva Late Panicle Hydrangea
U.S.	Hydrangea quercifolia	Oakleaf Hydrangea
N.	Hypericum kalmianum	St. John's wort
U.S.	Ilex glabra	Inkberry*
U.S.	Kerria japonica	Japanese Kerria
U.S.	Lonicera xylosteum	Clavey's Honeysuckle*
U.S.	Myrica pennsylvanica	Northern Bayberry
N.	Potentilla friuticosa	Potentilla
N.	Potentilla friuticosa varieties	Abbottswood, Gold Drop, Gold Finger, Jackman's Potentilla
N.	Physocarpus opulifolius	Common Ninebark
N.	Rhus aromatica 'Gro-Low'	Gro-Low Sumac
N.	Rhus glabra	Smooth Sumac
N.	Rhus typhinia	Staghorn Sumac
U.S.	Ribes alpinum	Alpine Currant
U.S.	Ribes alpinum 'Green Mound'	Green Mound Alpine Currant
U.S.	Rosa rugosa	Rugosa Rose, Pink Mediland, Red Mediland, Scarlet Mediland, and Carolina Rose
U.S.	Spirea x bumalda	Anthony Waterer, Froebel, Gold Flame, Gold Mound Spirea
U.S.	Spirea japonica	Little Princess Japanese Spirea
U.S.	Spirea nipponica	Snowmound Spirea
U.S.	Stephanandra incisa	Cutleaf Stephanandra
U.S.	Symphoricarpos albus	Common Snowberry
U.S.	Symphoricarpos x chenaultii	Chenault Coralberry

U.S.	Syringa spp.	Chinese Lilac, Meyer's Dwarf Lilac, Miss Kim Dwarf Lilac, and Japanese Tree Lilac
U.S.	Syringa vulgaris	Common Purple Lilac
U.S.	Syringa vulgaris var. alba	Common White Lilac
U.S.	Syringa vulgaris varieties	French hybrid Lilacs
U.S.	Viburnum x burkwoodii	Burkwood Viburnum
U.S.	Viburnum carlcephalum	Carlcephalum Viburnum
U.S.	Viburnum carlesii	Koreanspice Viburnum
N.	Viburnumdentatum varieties	Autumn Jazz, Chicago Lustre Arrowwood Viburnum*
U.S.	Viburnum x judii	Judd Viburnum
N.	Viburnum lentago	Nannyberry*
U.S.	Viburnum plicatum tomentosum	Doublefire Viburnum*
N.	Viburnum prunifolium	Blackhaw Viburnum*
U.S.	Viburnum sieboldii	Siebold Viburnum*
N.	Viburnum trilobum	American Cranberrybush*
N.	Viburnum tribolum compactum	Compact American Cranberrybush*
N.	Viburnum tribolum varieties	Haws, Wentworth Cranberrybush*
U.S.	Weigela florida	Weigela

Evergreen/Coniferous Shrubs

U.S.	Buxus micophylla varieties	Dwarf Korean Boxwood
U.S.	Ilex x meserveae 'Blue Prince' 'Blue Princess'	Meserve Holly 'Blue Prince' / 'Blue Princess'
U.S.	Ilex x meserve	China Boy and China Girl 'China boy' / 'China Girl' Meserve Holly
U.S.	Juniperus chinensis pfitzeriana	Pfitzer Juniper
U.S.	Junperus chinensis 'Sea Green'	Sea Green Juniper
N.	Juniperus horizontalis var.	Spreading Juniper varieties
U.S.	Juniperus procumbens	Japanese Garden Juniper
U.S.	Juniperus sargentii	Sargent Juniper
N.	Juniperus virginiana var.	Eastern Red Cedar varieties
U.S.	Rhododendron hybrids	P.J.M. hybrid Rhododendrons
U.S.	Taxus cuspidata varities	Japanese Yew varieties
U.S.	Taxus x media varieties	Anglo - Japanese Yew varieties
N.	Thuja occidentalis varieties	Arborvitae varieties
N.	Tsuga canadensis	Canadian Hemlock

Groundcovers

U.S.	Euonymus fortunei	Wintercreeper
U.S.	Euonymus fortunei colorata	Purpleleaf Wintercreeper
U.S.	Pachysandra terminalis	Pachysandra, Japanese Spurge
U.S.	Polygonum reynoutria	Fleece Flower
U.S.	Vinca minor	Periwinkle

Vines

N.	Celastrus scandens	Bittersweet
U.S.	Hydrangea periolaris	Climbing Hydrangea

N.	Parthenocissus quinquefolia	Virginia Creeper
U.S.	Parthenocissus tricuspidata	Boston Ivy
N.	Vitis riparia	Riverbank or Fox Grape*

Perennials / Forbs

U.S.	Alchillea x hybrid	Coronation Gold yarrow 'Coronation Gold'
U.S.	Alchillea x hybrid ëMoonshineí	Moonshine Yarrow
N.	Aquilegia canadensis	American Columbine
N.	Arunus dioicus	Goat's Beard
N.	Asclepias tuberosa	Butterfly Weed
N.	Aster nova-angliae 'Purple Dome'	Purple Dome New England Aster
U.S.	Astilbe x arendsii cultivars	Deutschland, Fanal, Rheinland astilbe
U.S.	Astilbe chinensis cultivars	Chinese Astilbe varieties
U.S.	Calamagrostis x acutiflora cultivars	Karl Foerster, Stricta Feather Reed Grass
N.	Chasmanthium latifolium	Northern Sea Oats
U.S.	Chrysanthemum maximum	Shasta Daisy
U.S.	Chrysanthemum superbum	Little Princess Shasta Daisy
U.S.	Coreoposis verticillata 'Moonbeam'	Moonbeam Coreopsis
U.S.	Dicentra spectabilis	Bleeding Heart
N.	Echinacea purpurea cultivars	Purple Coneflower
U.S.	Hemerocallis spp.	Daylily varieties
U.S.	Hosta spp.	Hosta Daylily varieties
U.S.	Iris siberica cultivars	Siberian Iris varieties
N.	Liatris spicata	Blazing Star
U.S.	Miscanthus sinensis cultivars	Purple, Silverfeather Maiden Grass
N.	Monarda didyma 'Cambridge Scarlet'	Cambridge Scarlet Bee Balm
N.	Panicum virgatum	Swith Grass
U.S.	Pennisetum alopecuroides	Hamelin and Common Fountain Grass
U.S.	Perovskia atriplicifolia	Russian Sage
U.S.	Phlox paniculata cultivars	Phlox varieties
U.S.	Rubeckia fulgida 'Goldstrum'	Goldstrum Black Eyed Susan
N.	Schizachyrium scoparium	Little Blue Stem
U.S.	Sedum spectabilis 'Autumn Joy'	Autumn Joy Sedum
N.	Sporobolus heterolepsis	Prairie Dropseed

Recommended Plant Palette for Development Zone

Large Deciduous (Shade) Tree

N.	Acer x freemanii 'Autumn Blaze'	Autumn Blaze hybrid Maples
U.S.	Acer ginnala	Amur Maple
N.	Acer rubrum	October Glory and Red Sunset Red Maples
N.	Acer saccharum varieties	Sugar Maple
N.	Acer saccharinum	Silver Maple
U.S.	Alnus glutinosa	European Black Alder
N.	Betula nigra	River Birch
N.	Celtis occidentalis	Hackberry
N.	Gleditsia triacanthos inermis	Thornless Honeylocusts
N.	Gleditsia triacanthos inermis 'Skyline'	Skyline Thornless Honeylocusts
N.	Quercus bicolor	Swamp White Oak
N.	Tilia americana	American Linden
U.S.	Tilia americana 'Redmond'	Redmond Linden
U.S.	Tilia x euchlora	Crimean Linden
U.S.	Tilia tomentosum 'Sterling Silver'	Sterling Silver Linden

Small Deciduous (Ornamental) Trees

N.	Amelanchier canadensis	Shadblow Serviceberry*
N.	Amelanchier x grandiflora	Apple Serviceberry*
N.	Amelancheir laevis	Allegheny Serviceberry*
N.	Celtis occidentalis	Hackberry*
N.	Cercis canadensis	Redbud
N.	Cornus alternifolia	Pagoda Dogwood*
U.S.	Cornus mas	Cornelian Cherry Dogwood*
N.	Crataegus crus - galli	Cockspur Hawthorn*
N.	Crataegus crus-galli inermis	Thornless Cockspur Hawthron*
N.	Crataegus mollis	Downy Hawthorn*
U.S.	Crataegus phaenopyrum	Washington Hawthorn*
N.	Crataegus punctata	Dotted Hawthorn*
N.	Crataegus viridis	Winter King Hawthorn*
U.S.	Malus varieties	Adams, Siberian, Jackii Siberian, Bob White, Beverly*,Donald Wyman, Prairiefire, Profusion, Red Jewel, Sargent, Snowdrift, Red Zumi, and Yellow Zumi crabapple

Deciduous Coniferous Trees

U.S.	Larix decidua	European Larch
N.	Larix laricina	American Larch
U.S.	Taxodium Distichum	Bald Cypress

Evergreen Coniferous Trees

U.S.	Picea abies	Norway Spruce
U.S.	Pinus flexilis	Lumber Pine
U.S.	Pinus mugo	Mugo Pine
U.S.	Pinus nigra	Austrian Pine

N.	Pinus stobus	White Pine
U.S.	Pseudotsuga menziesii	Douglas Fir

Deciduous Shrubs

N.	Aronia arbutifolia	Red Chokberry*
N.	Aronia melanocarpa	Black Chokeberry*
U.S.	Berberis thunbergii varieties	Japanese Barberry
U.S.	Buddleia davidii	Butterfly Bush
U.S.	Chaenomeles japonica	Japanese Flowering Quince
N.	Cornus sericea (stolonifera) 'Bailey'	Bailey's Redtwig Dogwood*
N.	Cornus sericea (stolonifera) 'Isanti'	Istanti Redtwig Dogwood*
U.S.	Cotoneaster spp.	Peking, Cranberry, Hesse, Rock Spray and Multiflorus Cotoneaster
U.S.	Dievilla sessilifolia	South Bush Honeysuckle
U.S.	Forsythia intermedia hybirds	Forsythia
U.S.	Forsythia viridissima	Bronx Forythia
N.	Hydrangea arborescens	Smooth Hydrangea
U.S.	Hydrangea paniculata varieties	Peegee Improved and Tardiva Late Panicle Hydrangea
U.S.	Hydrangea quercifolia	Oakleaf Hydrangea
N.	Hypericum kalmianum	St. John's wort
U.S.	Ilex glabra	Inkberry*
N.	Ilex verticillata varieties	Jim Dandy, Red Sprite, Winter Red Common Winterberry
U.S.	Kerria japonica	Japanese Kerria
U.S.	Lonicera xylosteum	Clavey's Honeysuckle*
U.S.	Myrica pennsylvanica	Northern Bayberry
N.	Potentilla friuticosa	Potentilla
N.	Potentilla friuticosa varieties	Abbottswood, Gold Drop, Gold Finger, Jackman's Potentilla
N.	Rhus aromatica 'Gro-Low'	Gro-Low Sumac
U.S.	Ribes alpinum	Alpine Currant
U.S.	Ribes alpinum 'Green Mound'	Green Mound Alpine Currant
U.S.	Rosa rugosa	Rugosa Rose, Beach Plum
U.S.	Rosa x 'Pink Meidiland'	Pink Mediland Rose
U.S.	Rosa x 'Red Meidiland'	Red Mediland Rose
U.S.	Rosa x 'Scarlet Meidiland'	Scarlet Meidiland Rose
U.S.	Rosa viriniana	Carolina Rose
U.S.	Spirea x bumalda	Anthony Waterer, Froebel, Gold Flame, Gold Mound Spirea
U.S.	Spirea japonica	Little Princess Japanese Spirea
U.S.	Spirea nipponica	Snowmound Spirea
U.S.	Stephanandra incisa	Cutleaf Stephanandra
U.S.	Symphoricarpos x chenaultii	Chenault Coralberry
U.S.	Syringa spp.	Chinese Lilac, Meyer's Dwarf Lilac, Miss Kim Dwarf Lilac, and Common Purple Lilacs

U.S.	Viburnum burkwoodii	Burkwood Viburnum
U.S.	Viburnumcarlcephalum	Carlcephalum Viburnum
U.S.	Viburnum carlesii	Koreanspice Viburnum
N.	Viburnumdentatum varieties	Autumn Jazz, Chicago Lustre Arrowwood Viburnum*
U.S.	Viburnum x judii	Judd Viburnum
N.	Viburnum lentago	Nannyberry*
U.S.	Viburnum plicatum tomentosum	Doublefire Viburnum*
N.	Viburnum prunifolium	Blackhaw Viburnum*
U.S.	Viburnum sieboldii	Siebold Viburnum*
N.	Viburnum trilobum	American Cranberrybush*
N.	Viburnum tribolum compactum	Compact American Cranberrybush*
N.	Viburnum tribolum varieties	Hahs, Wentworth American Cranberrybush*
U.S.	Weigela florida	Weigela

Evergreen Shrubs

U.S.	Buxus micophylla varieties	Dwarf Korean Boxwood
U.S.	Ilex x meserveae 'Blue Prince' / 'Blue Princess'	Meserve Holly Blue Prince and Blue Princess
U.S.	Ilex x meserve ë	China Boy and China Girl China boy' / 'China Girl' Meserve Holly
U.S.	Juniperus chinensis pfitzeriana	Pfitzer Juniper
U.S.	Junperus chinensis 'Sea Green'	Sea Green Juniper
N.	Juniperus horizontalis var.	Spreading Juniper varieties
U.S.	Juniperus procumbens	Japanese Garden Juniper
N.	Juniperus virginiana var.	Eastern Red Cedar varieties
U.S.	Rhododendron hybrids	P.J.M. hybrid Rhododendrons
U.S.	Taxus cuspidata varities	Japanese Yew varieties
U.S.	Taxus x media varieties	Anglo - Japanese Yew varieties
N.	Thuja occidentalis varieties	Arborvitae varieties
N.	Tusga canadensis	Canadian Hemlock

Groundcovers

U.S.	Euonymus fortunei	Wintercreeper
U.S.	Euonymus fortunei colorata	Purpleleaf Wintercreeper
U.S.	Pachysandra terminalis	Pachysandra, Japanese Spurge
U.S.	Polygonum reynoutria	Fleece Flower
U.S.	Vinca minor	Periwinkle

Vines

N.	Celastrus scandens	Bittersweet
U.S.	Hydrangea periolaris	Climbing Hydrangea
N.	Parthenocissus quinquefolia	Virginia Creeeper
U.S.	Parthenocissus tricuspidata	Boston Ivy
N.	Vitis riparia	Riverbank or Fox Grape*

Perennials / Forbs

U.S.	Alchillea x hybrid 'Coronation Gold'	Coranation Gold Yarrow
U.S	Alchillea x hybrid 'Moonshine'	Moonshine Yarrow
	Aquilegia canadensis	American columbine
	Arunus dioicus	Goat's Beard
	Asclepias tuberosa	Butterfly Weed
	Aster nova-angliae 'Purple Dome’	Purple Dome New England Aster
U.S	Astilbe x arendsii cultivars	Deutschland, Fanal, Rheinland Astilbe
U.S	Astilbe chinensis cultivars	Chinese Astilbe varieties
U.S	Calamagrostis x acutiflora cultivars	Karl Foerster, Stricta Feather Reed Grass
U.S	Chrysanthemum maximum	Shasta Daisy
U.S	Chrysanthemum superbum	Little Princess Shasta Daisy
U.S.	Coreoposis verticillata 'Moonbeam'	Moonbeam Coreopsis
U.S	Dicentra spectabilis	Bleeding Heart
N.	Echinacea purpurea cultivars	Purple Coneflower
U.S	Hemerocallis spp.	Daylily varieties
U.S	Hosta spp.	Hosta Daylily varieties
U.S	Iris siberica cultivars	Siberian Iris varieties
	Liatris spicata	Blazing Star
U.S	Miscanthus sinensis cultivars	Purple, Silverfeather Maiden Grass
	Monarda didyma ëCambridge Scarletí	Cambridge Scarlet Bee Balm
	Panicum virgatum	Swith Grass
U.S	Pennisetum alopecuroides	Hamelin and Common Fountain Grass
U.S	Perovskia atriplicifolia	Russian Sage
U.S	Phlox paniculata cultivars	Phlox varieties
U.S.	Rubeckia fulgidaë Goldstrumí	Goldstrum Black Eyed Susan
U.S	Sedum spectabilis 'Autumn Joy'	Autumn Joy Sedum

Appendix F: Safety Equipment

Life Preserver Rings

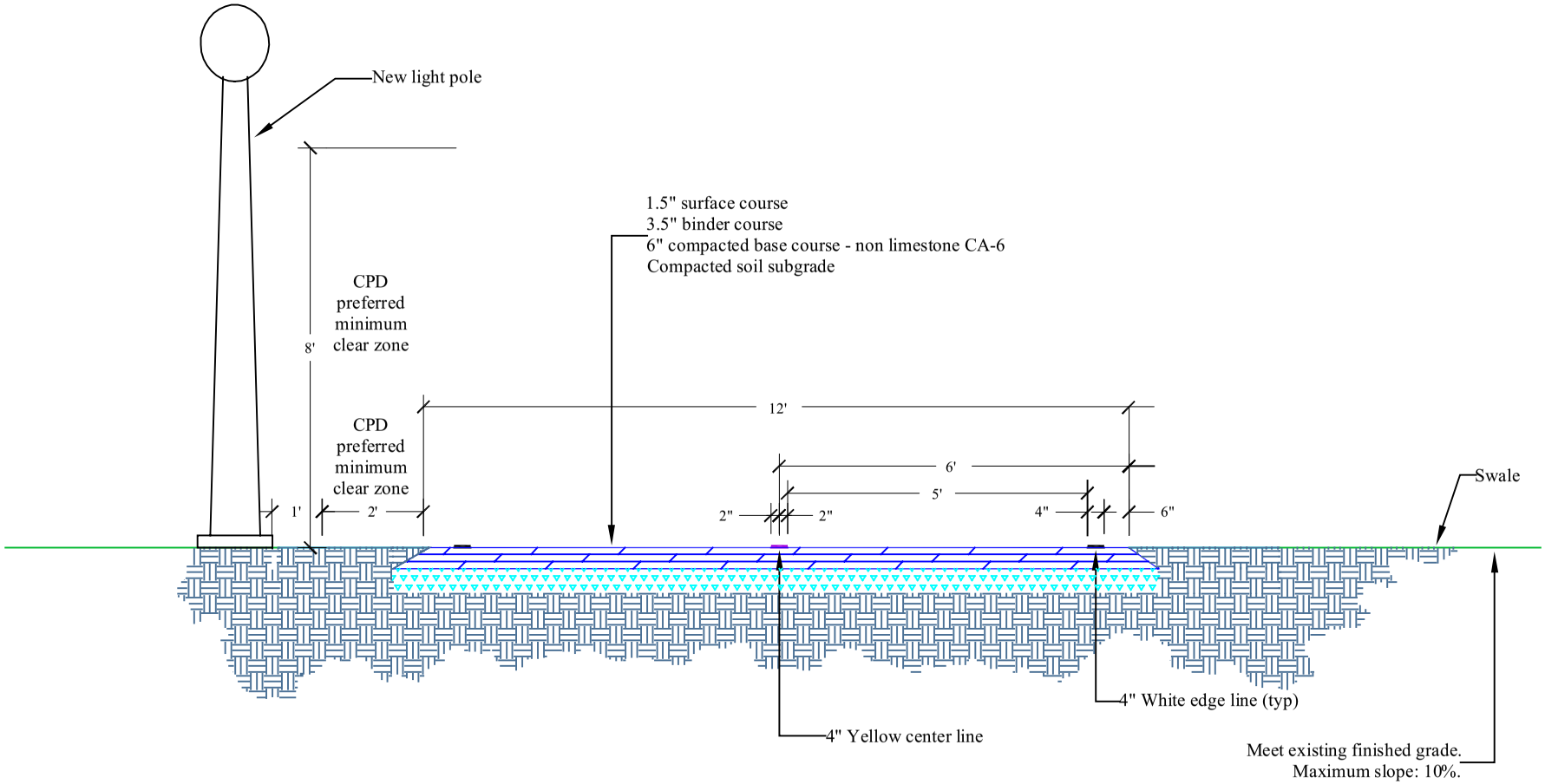
All life preserver rings shall be circular rings, 24 inches in diameter and white in color. The rope attached to the life preserver ring shall be white nylon rope, 3/8 inch in diameter and 100 feet in length. Life preserver rings should be spaced no further than 300 feet apart. Life preserver rings may be purchased from supplier of marine equipment and must be approved for use by the US Coast Guard.

Seawall Ladders

Seawall ladders are fabricated of stainless steel. Seawall ladders measure 24 inches wide with the length varying according to the distance from the top of the seawall to the low water point of the site. Ladder rungs are 3/4 to 1 inch in diameter, with a 1 foot spacing between rungs. Rungs are welded onto a flat steel member that is 3 inches wide by 1/2 inch thick. Seawall ladders should be installed no further than 300 feet apart.

APPENDIX G: CHICAGO PARK DISTRICT RIVERFRONT TRAIL

The following are sample riverfront trail specifications used by the Chicago Park District. The width of the riverfront trail will vary from 8 - 12 ft depending on intensity of use and character of the riverwalk.



1. RIVERFRONT TRAIL - STANDARD CROSS SECTION

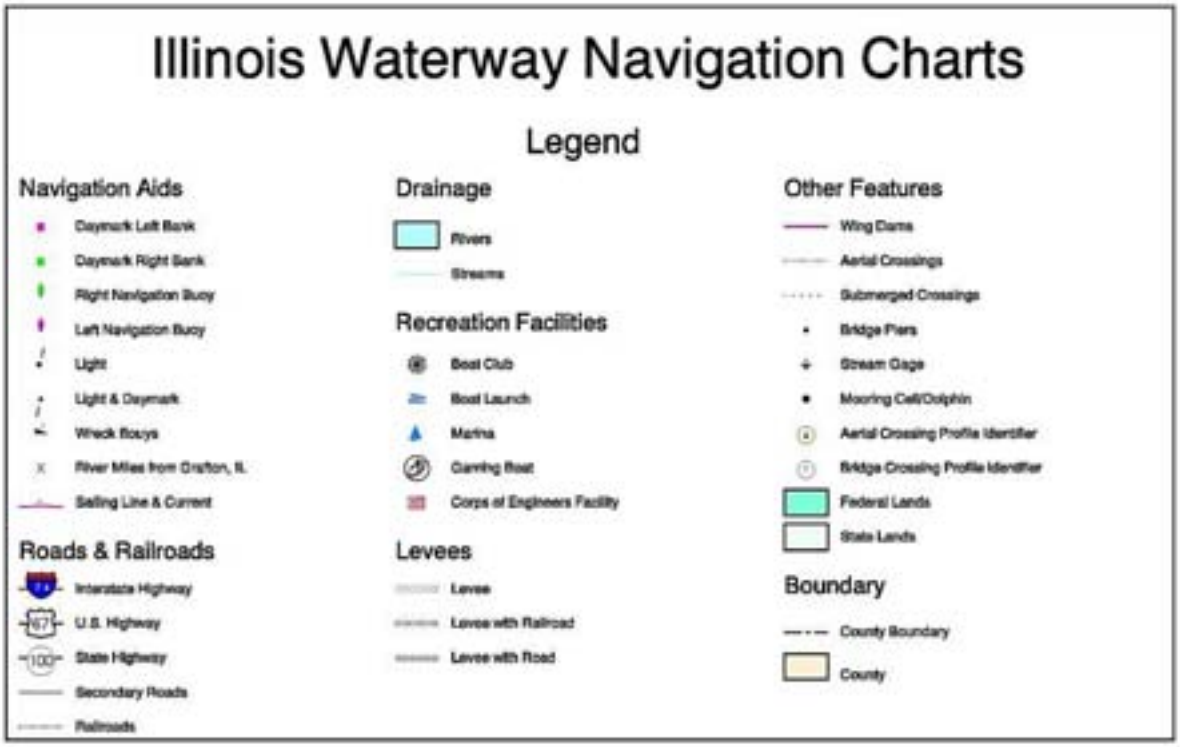
Scale 1" = 40'
OCT 29,2002
REVISION

Appendix H: Federal Navigation Channel

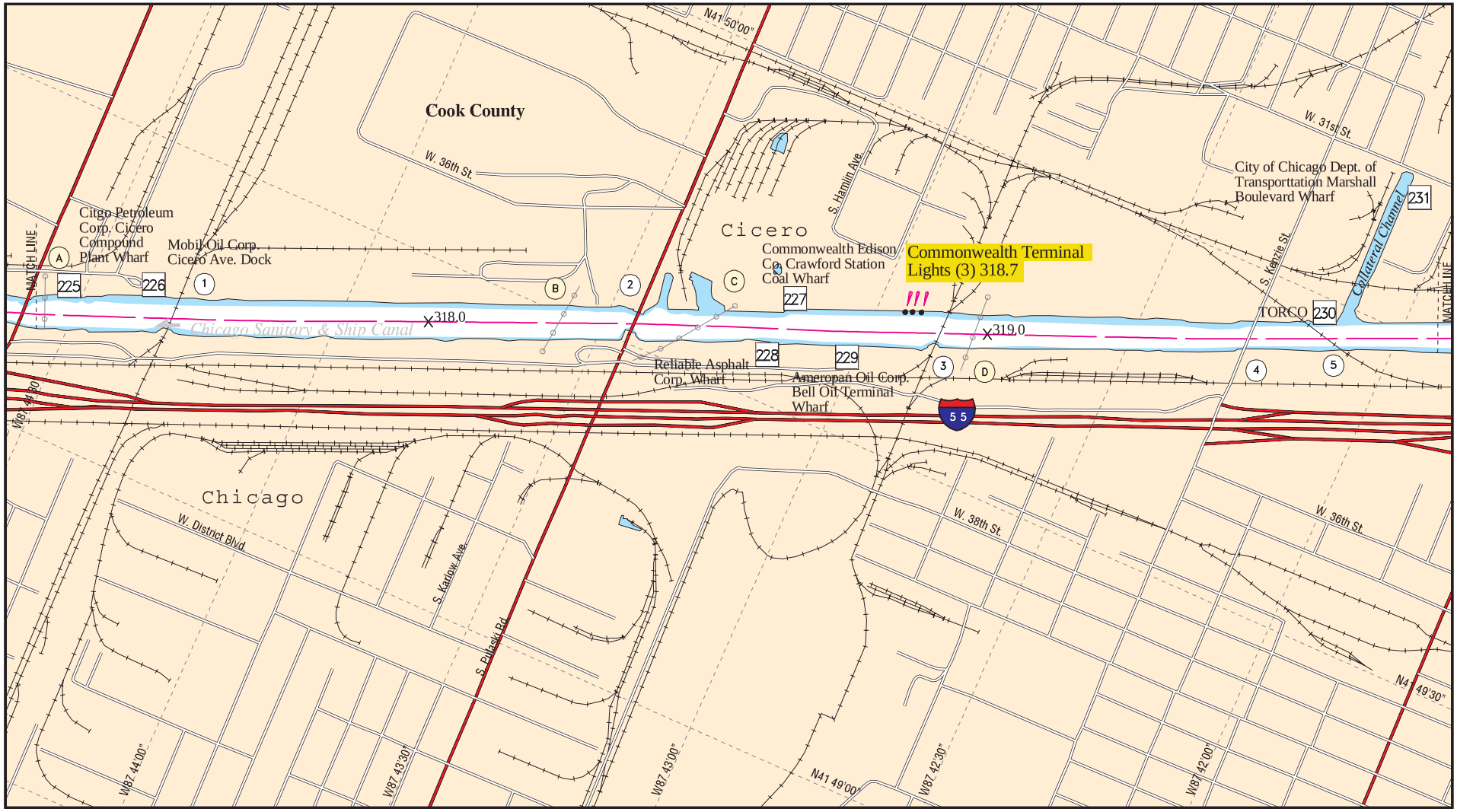
The following are maps from the U.S. Army Corps of Engineers delineating the Federal Navigation Channel within the Chicago River Waterway * (source: U.S. Army Corps of Engineers Illinois Waterway Charts).

* Blue area on navigation maps indicate portion of channel outside federal navigation channel.

Illinois Waterway Navigation Charts



US ARMY CORPS OF ENGINEERS ILLINOIS WATERWAY MILE 317.2 TO 319.8



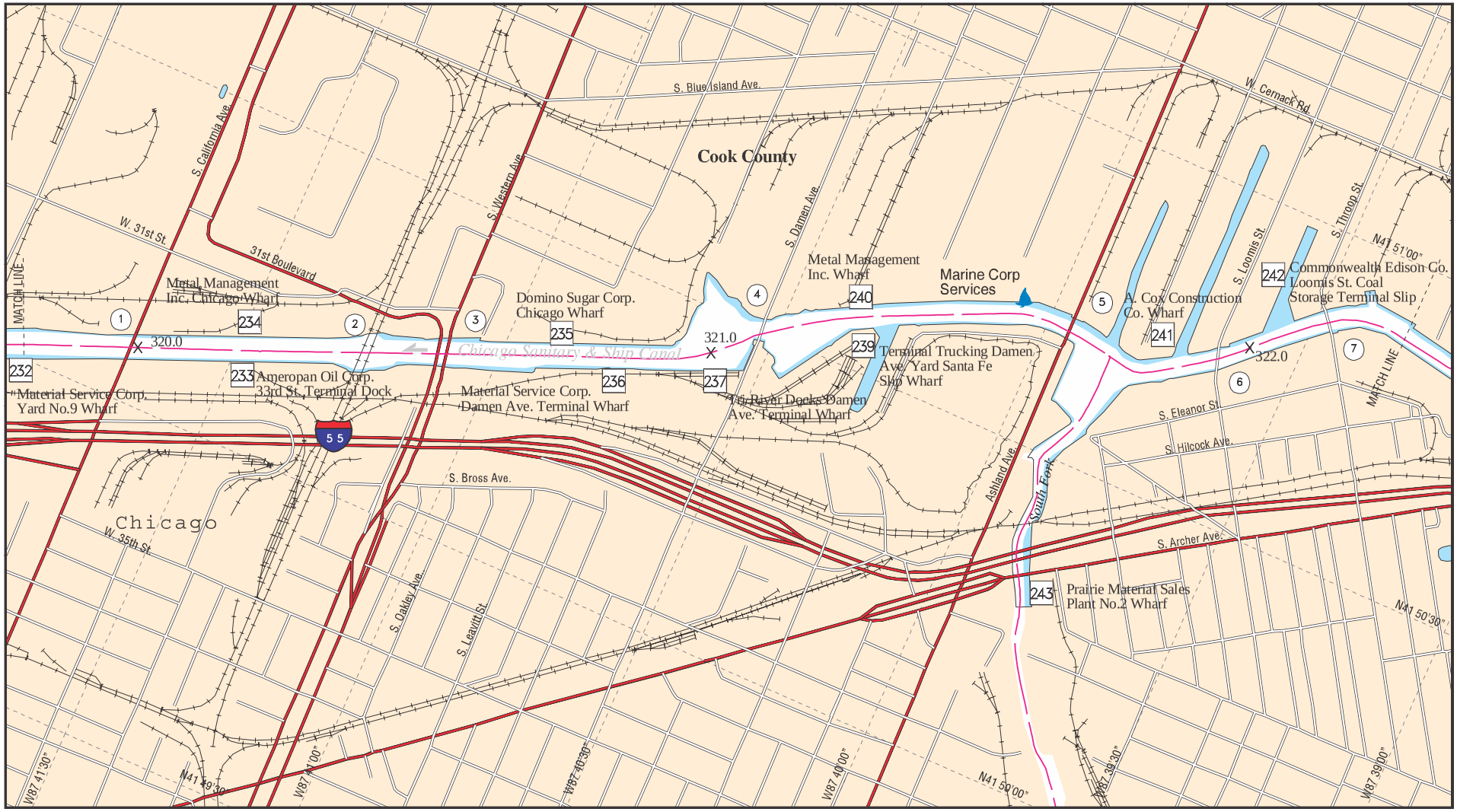
1998

1) The legend is located immediately preceding map No. 1
2) Barge Facility information and submerged cable and pipeline clearances are located in appendices A and B respectively.

Scale 1:12000 Scale 1" = 1000 Feet
0 1150 2300 ft

MAP NO. 125

US ARMY CORPS OF ENGINEERS ILLINOIS WATERWAY MILE 319.8 TO 322.2



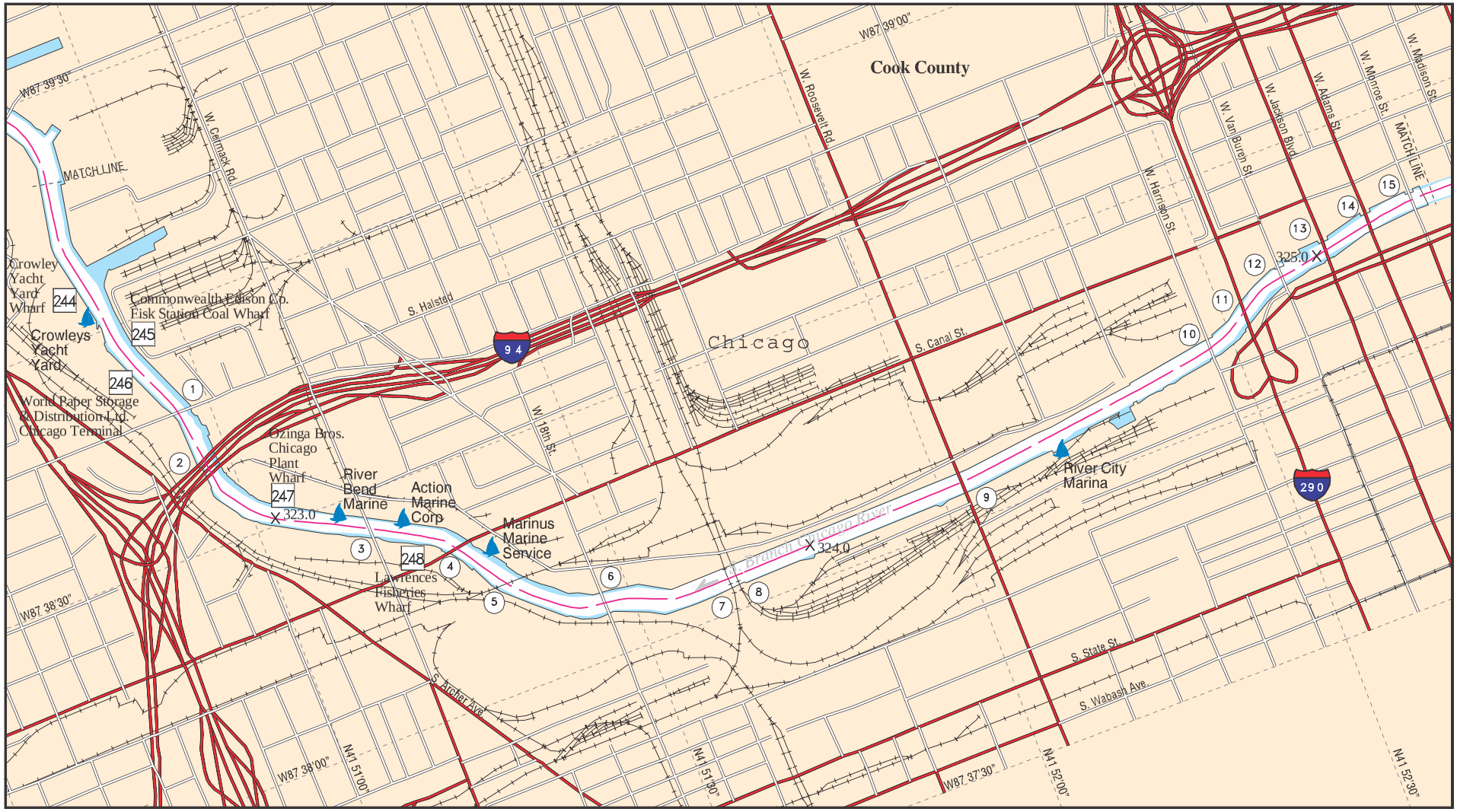
1998

1) The legend is located immediately preceding map No. 1
2) Barge Facility information and submerged cable and pipeline clearances are located in appendices A and B respectively.

Scale 1:12000 Scale 1" = 1000 Feet
0 1150 2300 ft

MAP NO. 126

US ARMY CORPS OF ENGINEERS ILLINOIS WATERWAY MILE 322.2 TO 325.2



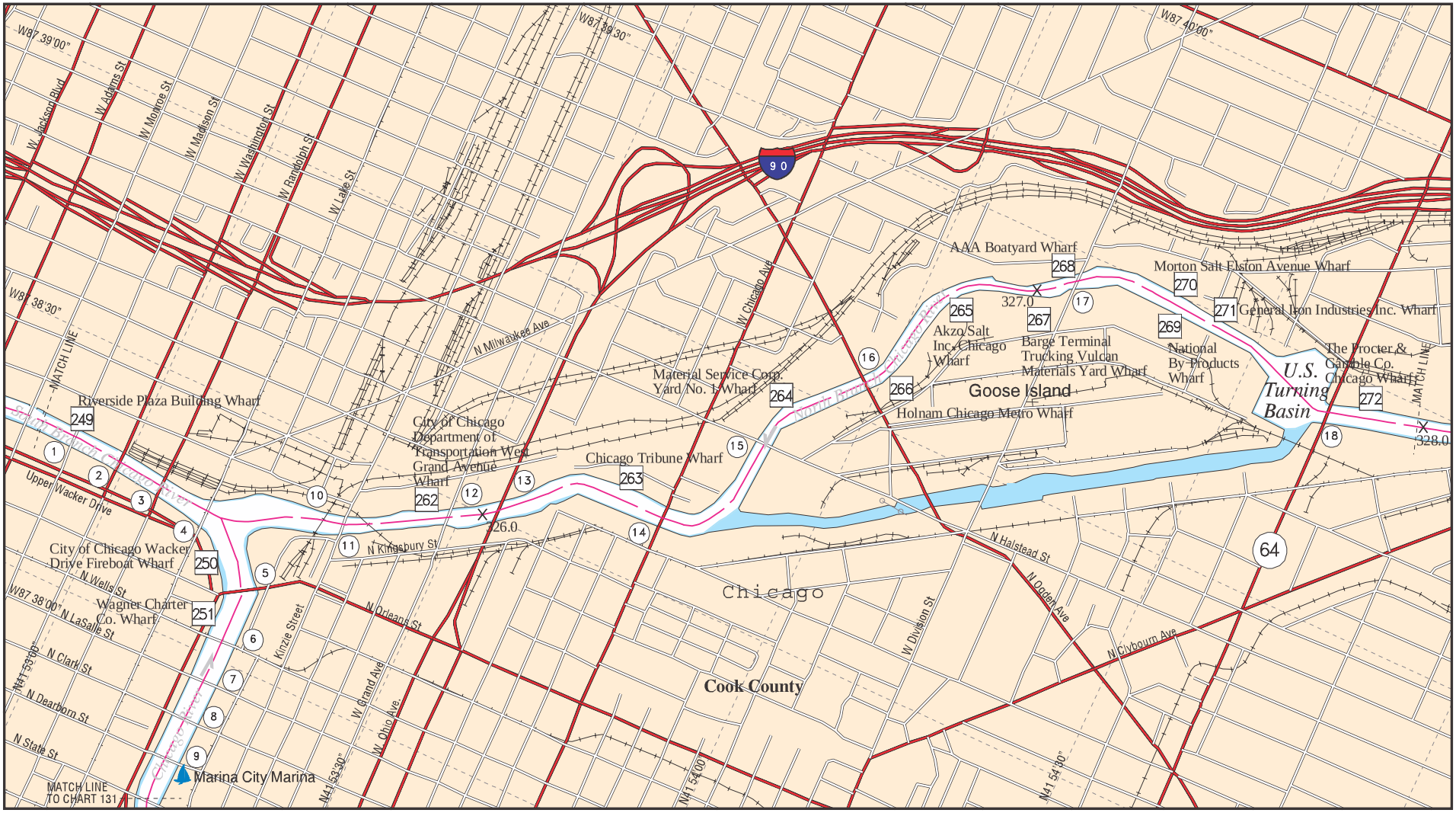
1998

1) The legend is located immediately preceding map No. 1
2) Barge Facility information and submerged cable and pipeline clearances are located in appendices A and B respectively.

Scale 1:12000 Scale 1" = 1000 Feet
0 1150 2300 ft

MAP NO. 127

US ARMY CORPS OF ENGINEERS ILLINOIS WATERWAY MILE 325.2 TO 328.0



1998

1) The legend is located immediately preceding map No. 1
2) Barge Facility information and submerged cable and pipeline clearances are located in appendices A and B respectively.

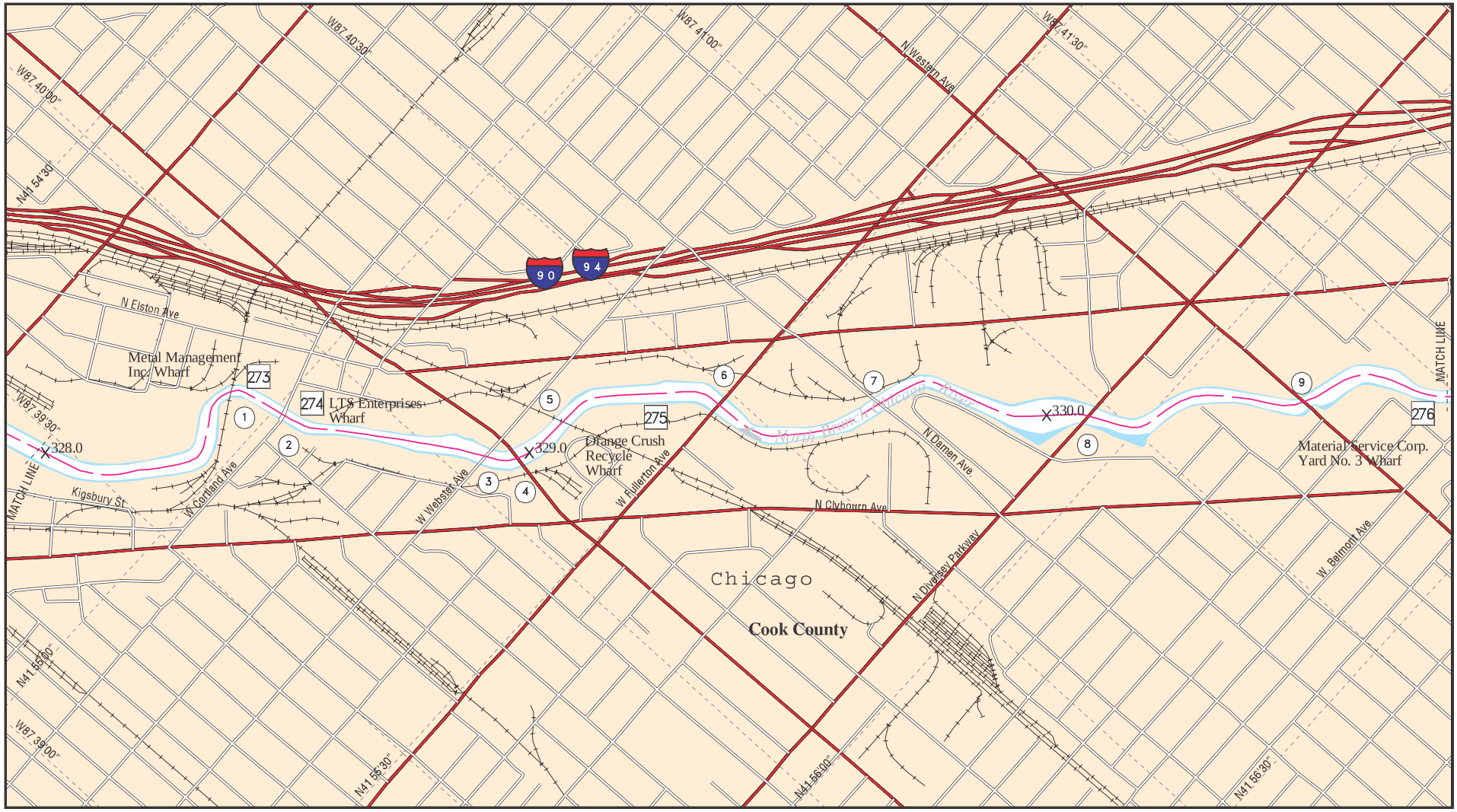
Scale 1:12000 Scale 1" = 1000 Feet

0 1150 2300 ft

MAP REVISEDMARCH 1999
REF. NAV NOTICE IW99-05

MAP NO. 128

US ARMY CORPS OF ENGINEERS ILLINOIS WATERWAY MILE 328.0 TO 330.7



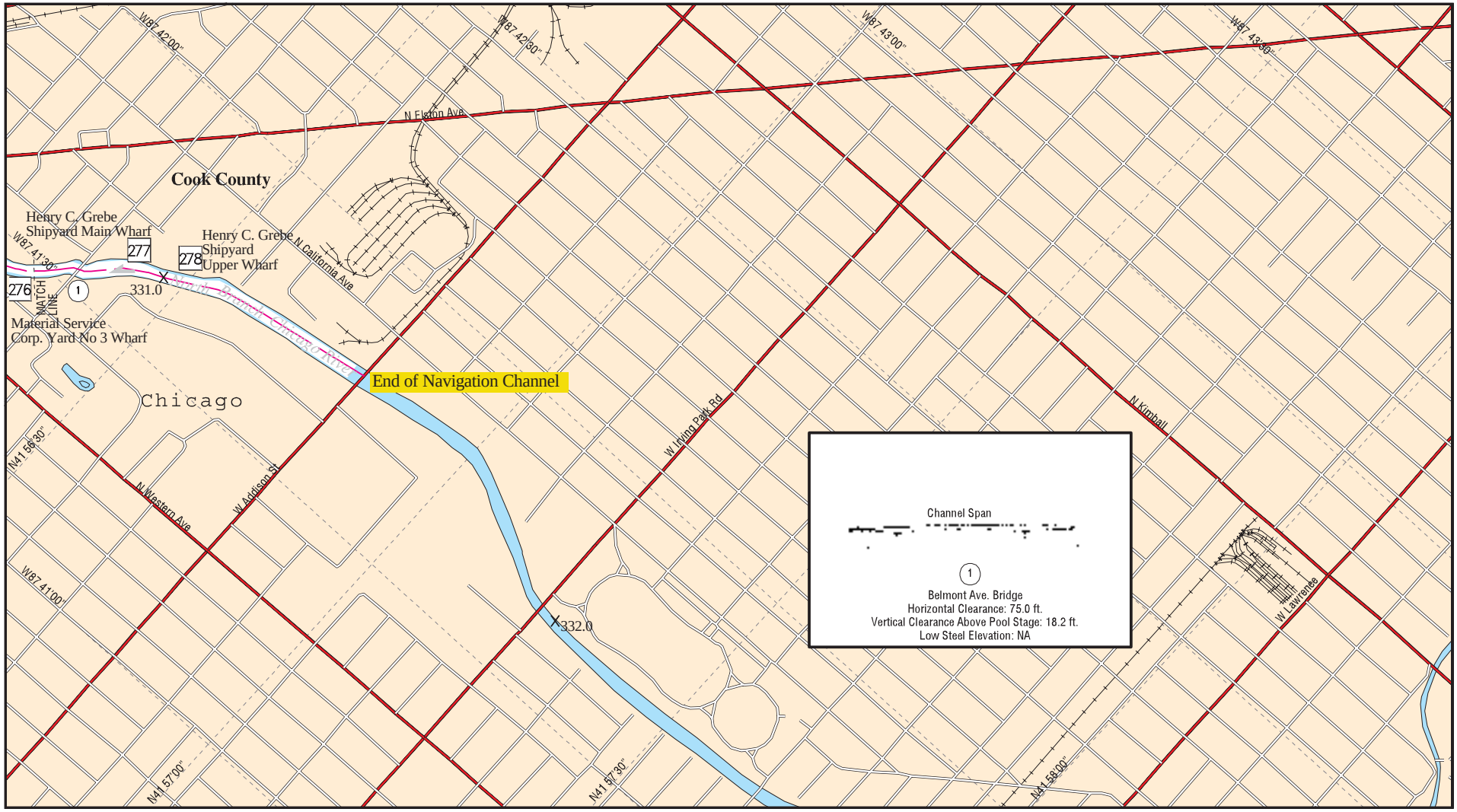
1998

1) The legend is located immediately preceding map No. 1
2) Barge Facility information and submerged cable and pipeline clearances are located in appendices A and B respectively.

Scale 1:12000 Scale 1" = 1000 Feet
0 1150 2300 ft

MAP NO. 129

US ARMY CORPS OF ENGINEERS ILLINOIS WATERWAY MILE 330.7 TO 331.5



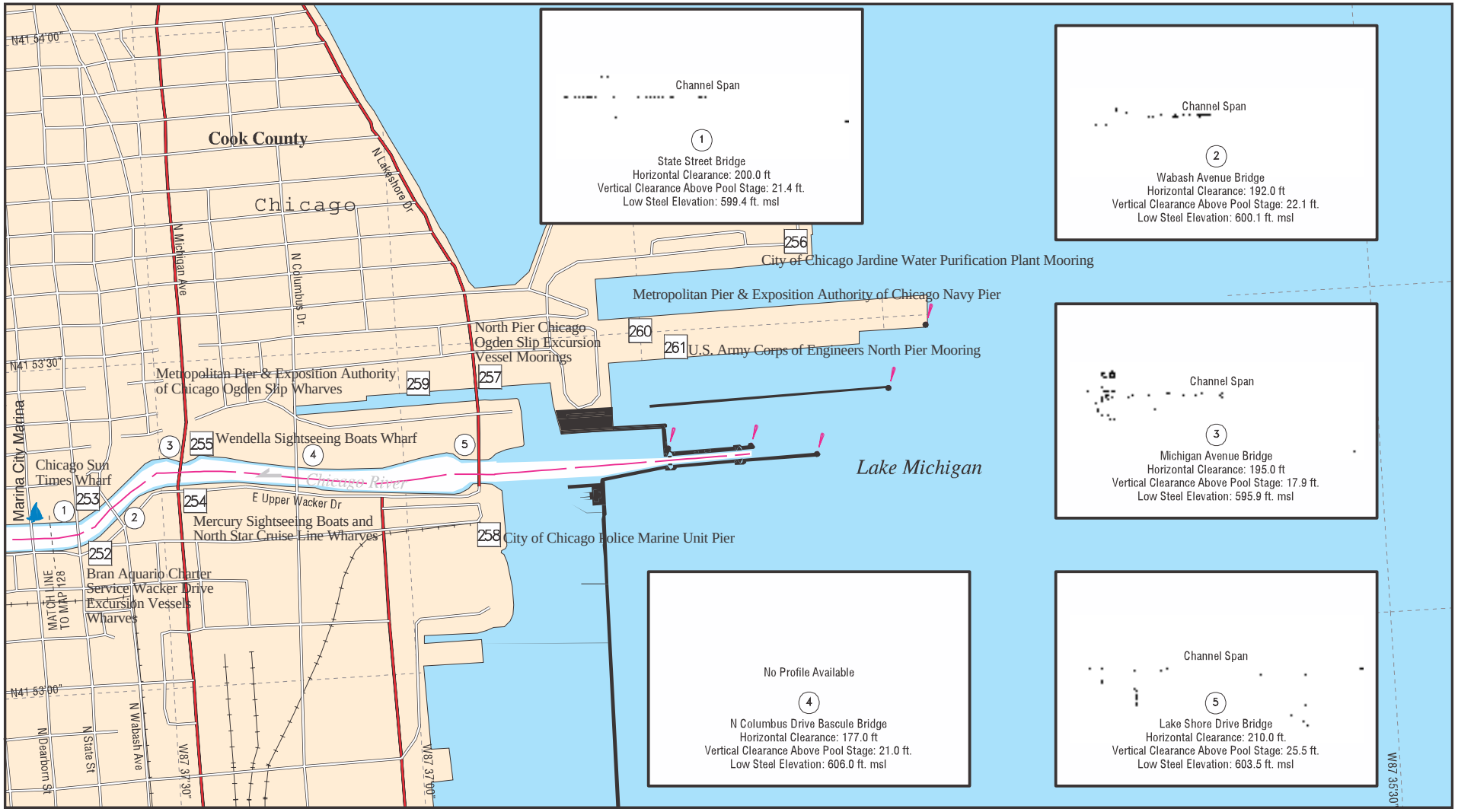
1998

1) The legend is located immediately preceding map No. 1
2) Barge Facility information and submerged cable and pipeline clearances are located in appendices A and B respectively.

Scale 1:12000 Scale 1" = 1000 Feet
0 1150 2300 ft

MAP NO. 130

US ARMY CORPS OF ENGINEERS ILLINOIS WATERWAY MILE 326.1 TO 326.7



1998

1) The legend is located immediately preceding map No. 1
2) Barge Facility information and submerged cable and pipeline clearances are located in appendices A and B respectively.

Scale 1:12000 Scale 1" = 1000 Feet
0 1150 2300 ft

N W E S

MAP NO. 131

Appendix I: City of Chicago Harbor Permit Review

Harbor Permit Review Process

Department of Construction and Permits is responsible for the issuance of permits for construction projects in the City of Chicago, however, the Chicago Department of Transportation has the responsibility of approving City Harbor Permits. CDOT has the authority to regulate construction activity in and adjacent to the City of Chicago waterways and is pleased to provide the following information regarding obtaining a harbor permit.

A City Harbor Permit is needed to perform construction within 40 feet of the waterway (shoreline, riverbank, dockwall/ riverwall, beach, etc.). CDOT will assist residential and business developments with the renovation of the City's shores. The City of Chicago encourages the appropriate treatment of riverbanks to preserve and enhance the attractiveness of this great natural resource for both people and wildlife to enjoy.

CDOT permit review process is triggered by:

- Department of Zoning Permit application
- Office of Underground Coordination

After reviewing the project drawings and scope of work CDOT will determine what drawings need to be submitted for the issuing of a Harbor Permit and also inform the applicant as to the permits that may be required from other city, county, state and federal agencies.

CDOT will **NOT** issue a Harbor Permit until all permits have been obtained from all other government agencies including Metropolitan Water Reclamation District, Illinois Department of Natural Resources and Army Corps of Engineers and United States Coast Guard.

See the Jurisdiction Chart on the left for the agency jurisdictions and responsibilities.

When are Harbor Permits required?

A City Harbor Permit is required when any work in and within 40 feet of the Base Flood Elevation of any City of Chicago waterway is being performed. The Federal Emergency Management Agency (FEMA), Illinois Department of Natural Resources - Office of Water Resources (IDNR/DWR) and Department of Planning and Development have established the Base Flood Elevation (BFE) for the city's waterways.

The Chicago Department of Transportation Harbor Review process begins with either a request for the Office of Underground Coordination or a Zoning permit application through the Department of Construction and Permits. The utility companies have 30 days to review the drawings and comment.

Project drawings, scope of work and owners information are sent to the Bureau of Bridges and Transit for a preliminary Review. If CDOT determines that the proposed work is not within 40 feet of the Base Flood Elevation of any Chicago waterway, then a Harbor Permit not required.

Examples of Work that Require A Harbor Permit:

- Dockwalls (steel sheet piling, H-piles and wood lagging, concrete, etc.)
- Buildings (foundations, walls, slabs, etc.)
- Earth Retention Systems
- Storm Sewer Outfalls
- Riverwalk and landscaping
- Repairs to existing dockwalls
- Temporary structures
- Bridge repair and reconstruction
- Soil borings
- Directional Bores and/or tunneling
- Demolition and backfilling

Requirements for Harbor Permits

CDOT requires drawings stamped by a registered Professional Engineer and/or Structural Engineer.

The following is a list of drawings that may be required:

- Plat of Survey
- Existing Site Plan with all existing conditions including utilities shown
- Proposed Site Plan
- Limits of the proposed work
- Locate proposed work from the right-of-way lines
- Typical cross-sections of all proposed work
- Elevation in Chicago City Datum (CCD) of top of riverbank, dockwall, riverwalk, landscaping, etc.
- Elevation of water in CCD
- Elevation of floor slabs (basement and ground floor)
- Elevation of top and bottom of foundations (footings, caissons, h-piles, etc.)
- Elevation of top and tip of sheet piling
- Distance from the nearest improvement/ work to the edge of the waterway.
- Design calculations
- Geotechnical Investigation report

Harbor Permits - Agency Jurisdictions and Responsibilities

Permit or Approval Required | Operational Role | Administrative/ Regulatory Role

Activity	ACOE	Coast Guard	U.S. EPA	IEPA	IDOC	IDOT/DWR	NIPC	MWRD	CDOT	DCAP	DPD	Police	Planning Commission	City Council	DOE	DWM
Bulkhead construction	●			●		●			●	●						
Dredging and Excavation	●			●		●			●	●						●
Bridge and underwater structure construction	●	●							●	●						
Filling, breakwater & dam construction	●			●		●			●	●						
Waterfront building construction									●	●	▲		●1	●1		
Floodplain construction										●					▲	
Wetland filling	●			●						●					▲	
Navigable channel designation	▲															
Navigable channel & harbor maintenance	◉															
Removal of navigation hazards	◉	◉						◉								
Maintenance of navigation aids		◉														
Environmental impact review	▲		▲	▲		▲	▲									
Water quality management			▲	▲	▲	▲		▲							▲	
Water quality monitoring								◉							▲	
Discharge Regulations				▲	▲	▲		▲							●	●
Overbank spillage & pollution control				▲				▲		▲					▲	
Clean-up of waterways & banks								◉							▲	
Protection of life & property		◉										◉				
Licensing of commercial vessels		●			●											
Licensing of recreational vessels					●											
Monitoring of commercial traffic	▲															
Monitoring of hazardous natl. shipments		▲		▲												
Moveable bridge operation									◉							
Lock and dam structure operation	◉							◉								
Water level and flood control	▲							◉								

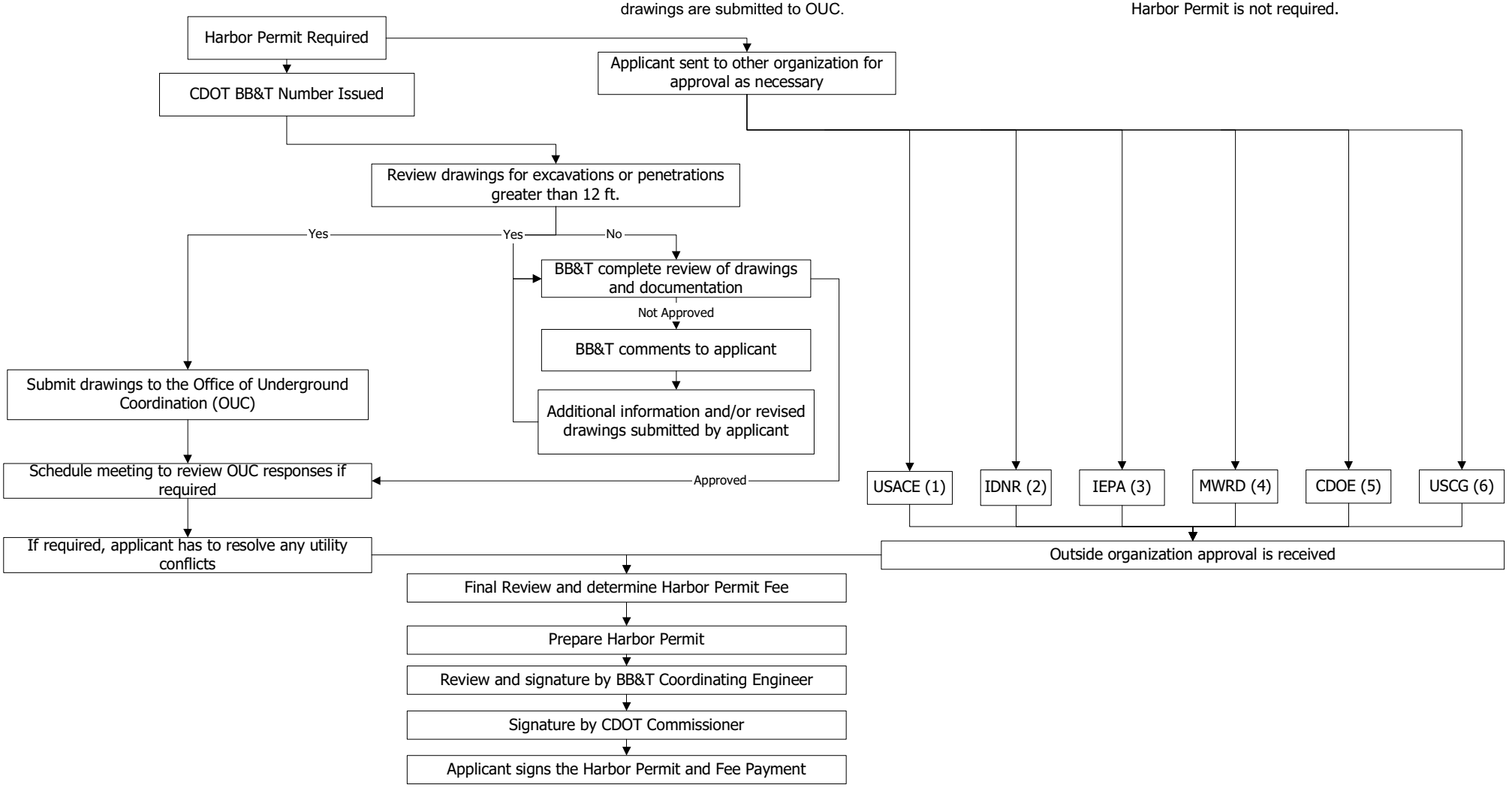
AGENCY KEY

ACOE	Army Corps of Engineers
Coast Guard	U.S. Coast Guard
U.S. EPA	United States Environmental Protection Agency
IEPA	Illinois Environmental Protection Agency
IDOC	Illinois Department of Conservation
IDOT/DWR	Illinois Department of Transportation/ Illinois Department of Natural Resources- Department of Water Resources
NIPC	Northeastern Illinois Planning Commission
MWRD	Metropolitan Water Reclamation District
CDOT	Chicago Department of Transportation
DCAP	Department of Construction and Permits
DPD	Department of Planning and Development
Police	Chicago Police Department
Planning Commission	Chicago Planning Commission
City Council	Chicago City Council
DOE	Department of Environment
DWM	Department of Water Management

Harbor Permit Review

*Office of Underground Coordination (OUC): The utility companies have 30 days to review the drawings and comment. This process takes a minimum of 35 days from the date the drawings are submitted to OUC.

*If the preliminary review by CDOT Bureau of Bridges and Transit (BB&T) determines that the proposed work is not within 40 feet of the Base Flood Elevation of any City of Chicago waterway, then a Harbor Permit is not required.


Harbor Permit Required
CDOT BB&T Number Issued
Applicant sent to other organization for approval as necessary
Review drawings for excavations or penetrations greater than 12 ft.
Yes
Yes
No
BB&T complete review of drawings and documentation
Not Approved
BB&T comments to applicant
Additional information and/or revised drawings submitted by applicant
Submit drawings to the Office of Underground Coordination (OUC)
Schedule meeting to review OUC responses if required
Approved
If required, applicant has to resolve any utility conflicts
USACE (1)
IDNR (2)
IEPA (3)
MWRD (4)
CDOE (5)
USCG (6)
Outside organization approval is received
Final Review and determine Harbor Permit Fee
Prepare Harbor Permit
Review and signature by BB&T Coordinating Engineer
Signature by CDOT Commissioner
Applicant signs the Harbor Permit and Fee Payment

1.) **Unite States Army Corps of Engineers**
Chicago District Regulatory Branch
111 N. Canal Street, Suite 600
Chicago IL, 60606
312-353-6400 (Main)

2.) **Illinois Department of Natural Resources**
Office of Water Resources
36 South Wabash, Suite 1415
Chicago IL, 60603

James Casey jcasey@ndrmail.state.il.us
312-793-3123

3.) **Illinois Environmental Protection Agency**
1021 N. Grand Avenue East.
P.O. Box 19276
Springfield IL, 62794-9276

Surface Water/ Watershed Management Section
217-782-3362

4.) **Metropolitan Water Reclamation District of Greater Chicago**
100 East Erie Street
Chicago IL, 60611
312-751-5600

Joseph Schuessler
joseph.schuessler@mwrd.org
312-751-4059

5.) **Department Of Environment**
30 North LaSalle, Suite 2500
Chicago IL, 60602
312-744-7606

6.) **United States Coast Guard**
Marine Safety Office Chicago

Attn: Waterways Management
215 West 83rd Street
Burr Ridge, IL 60527
630-986-2155

Appendix J: Pollution of Waters Ordinance

CITY OF CHICAGO MUNICIPAL CODE
ARTICLE VIII. POLLUTION OF WATERS

11-4-1410 Disposal in waters prohibited.
No person shall throw, discharge, dump, dispose or deposit, or cause, suffer, allow or procure to be thrown, discharged, disposed or deposited in Lake Michigan within three miles of the corporate limits or in any other waters within the corporate limits any waste or material of any kind unless such person has obtained (a) permits pursuant to the Clean Water Act from all applicable federal or state agencies and (b) all other necessary approvals and permits from federal, state and local regulator bodies or special districts.

11-4-1420 Ballast tank, bilge tank or other discharge.
No operator of any vessel, craft, floats or motorboat shall throw, discharge, dump, dispose or deposit into any waters any fuel, solid or liquid, or the contents of any ballast tank, bilge tank or other container capable of causing pollution of waters.

11-4-1430 Waste retention tank.
All vessels, crafts, floats and motorboats equipped with toilets, heads, urinals or capable of discharging galley wastes which have not been discharged through a grease trap or grease interceptor, or solid or liquid waste from shipboard hospital facilities, shall be equipped with a waste retention tank of approved type and capacity to store such waste material for subsequent disposal at a legally operating shoreside facility.

11-4-1440 Wharfs, docks and similar structures in unsafe condition.
Every wharf, dock, pier, seawall, riverbank retaining wall, riverbank bulkhead, dolphin, boom, bulkhead, jetty mooring facility, piling, sheeting or other similar structure on or appurtenant to premises abutting on any waters which has disintegrated, rotted, deteriorated or is otherwise out of repair, or is in unsanitary condition, or in an unsafe or dangerous condition, or which in any manner endangers the health or safety of any person or persons or which in any manner endangers navigation is hereby declared to be a public nuisance.

11-4-1450 Gas manufacturing residue.
No person being a manufacturer of gas, or engaged about the manufacture

thereof, shall throw, deposit or allow to run, or permit to be thrown or deposited into any waters, or into any sewer therewith connected, any gas-tar or any refuse matter of or from any gashouse, works or manufactory.

11-4-1460 Enforcement.
(a) Violations of Sections 11-4-1410 through 11-4-1450 shall be punishable by a civil penalty of $1,000.00 to $2,000.00 for the first offense, $2,000.00 to $4,000.00 for the second offense and $4,000.00 to $10,000.00 for each third and subsequent offense. Each day that the violation continues shall be deemed a separate offense.
(b) The Department may issue cease and desist orders for any violation of Sections 11-4-1410 through 11-4-1450. Violations of a cease and desist order shall be punishable by a civil penalty of $5,000.00. Each day that the violation continues shall be deemed a separate offense.
(c) The department or the city may obtain permanent or temporary injunctive relief in the Circuit Court of Cook County, Illinois, for any violation of Sections 11-4-1410 through 11-4-1460.

APPENDIX K: RIVERBANK RESTORATION SOLUTIONS

The following are natural riverbank restoration solutions that can be used on the Chicago River (source: Chicago Park District River Master Plan)

Riverbank & Slope Treatments

The banks along the Chicago River are experiencing two distinct types of erosion. One type of erosion is caused by flowing water, the other is caused by surface runoff.

Riverbank erosion caused by flowing river water occurs when high velocity flow erodes the toe of the slope. Once significant material is lost from the toe, the upper bank becomes overly-steep or loses its foundation and slope failure occurs. The upper banks are generally protected from direct erosion induced by flowing river water (due to significant tree cover on the riverbank). However, contrary to conventional wisdom, a heavily wooded riverbank is generally not sufficient erosion protection.

While tree roots provide some level of protection of bank soils, the coarseness of the roots allows flow at the toe of the slope to erode soil from around them. Once the erosion progresses to a sufficient degree, the tree eventually topples and causes catastrophic soil loss as the root fan dislodges a substantial portion of the bank.

Deep-rooted herbaceous vegetation has very fine roots that bind the soil together. Further, the roots are continuously regenerated, increasing stability over time. While no purely vegetative method is likely to completely stop erosion under the conditions experienced along most of the Chicago River, a healthy and diverse layering of deep-rooted grasses, sedges, and forbs will considerably slow the erosion and help hold the slopes.

The other type of erosion observed on the banks of the river is sheet erosion, which is caused by surface runoff down the slope. In some areas, the source of runoff is adjacent paved surfaces (such as parking lots, tennis courts, etc.) or lawn areas that directly drain to the banks. In other areas, the slopes are sufficiently long enough that runoff from the slope itself appears to cause erosion. This type of erosion is common on densely wooded slopes (virtually all of the parks) that have no vegetative cover to protect the soil surface from sheet and rill erosion. With sufficient thinning of the tree canopy and understory, deep-rooted herbaceous cover can be established. The herbaceous cover protects the soil surface from erosion and prevents or slows down runoff from the slope itself.

Riverbank erosion treatments for the parks along the Chicago River are broken into two groups – river edge treatments and slope treatments. Most reaches of the river will require both river edge and slope treatments.

River Edge Treatments

River edge treatments are intended to address riverbank erosion at the toe of the slope caused by flowing river water and wave action. The river edge treatments generally address the normal water line up to approximately 2 feet. The demarcation between river edge and slope treatments will vary depending on the amount of water level fluctuation and wave height.

Slope Treatments

Slope treatments are intended to address the slope approximately 2 feet above the normal water level. In most cases, the slope treatment must be combined with toe protection at the water's edge.

Treatment Options

Within four of the parks two options are proposed for stabilizing the toe of slope and riverbank. In general, Option A involves regrading of the banks to a shallow stable slope and using rock to stabilize the toe. Due to the steepness of the banks and height, Option A can not be implemented without losing most or all of the trees along the river. However, installation of scattered native oaks and hickories consistent with open woodland landscapes are included in the cost estimate for Option A.

Option B generally involves installation of sheetpile to reduce regrading of the upper bank and may allow preservation of some of the existing trees along the river. However, in most of these parks the existing trees are non-native and their density is contributing to bank erosion. Thus Option B includes significant thinning of the existing tree and shrub cover even where complete removal is not necessary.

1. River Edge Treatment - Stacked Flat Rock

Stacked flat rock such as limestone, granite, or broken concrete slabs provides a relatively aesthetic and functional alternative for shoreline treatment in urban settings. This treatment is present along many areas of the Upper North Branch upstream of the confluence of the North Shore Channel. Though the time of installation in these areas is unknown, much of it appears to have been present for decades and be quite stable. The greatest source of failure of this treatment appears to be tree roots dislodging individual slabs. In addition, stacked flat rock offers a seating and walking surface at the water's edge that accommodates walkers, anglers, and others. The reestablished slope should be seeded, covered with erosion control blanket, and planted with native plugs as necessary.

If stacked flat rock treatment is installed with stable, overhanging slabs adjacent and within the water, this may provide cover for some macroinvertebrate species. This may also provide a resting area for waterfowl and possibly other species. This type of treatment will not create a habitat per se, but it may provide resting and cover opportunities for some fauna species.

Advantages:

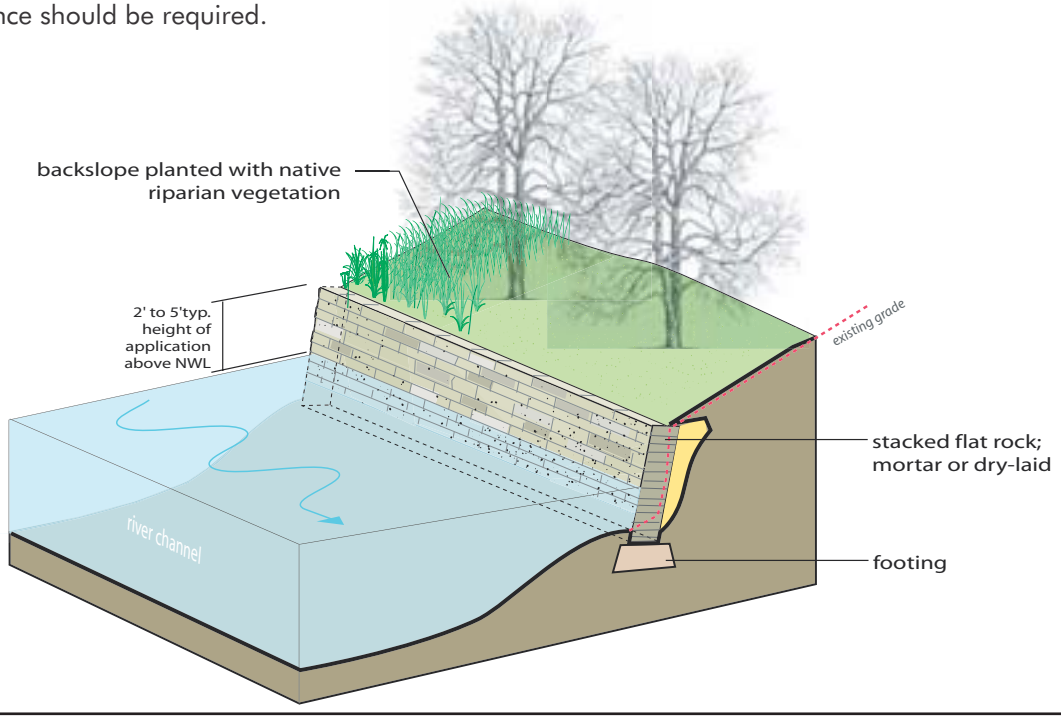
- Provides significant toe protection from flow and wave energy.
- Can be mortared or stacked (gravity).
- Visually appealing along an urban river.
- Provides access to the water's edge (fishing, walking, etc).
- Stone will absorb and resist wave action.
- Provides some level of macroinvertebrate habitat, which can be important in the Chicago River where the majority of the bottom is very silty and devoid of macroinvertebrate habitat.
- Opportunity for use of recycled material.

Disadvantages:

- Tends to transmit flow and reflect wave energy.
- Subject to failure where there is potential movement in the riverbed.
- Can be expensive, depending on height of wall and material used. Cost may be relatively low in areas where an existing wall can be rebuilt using material still present.
- Possible vandalism concerns, depending on the size of the material. No significant vandalism of existing stack walls was observed.
- There may be significant wetland and floodway permitting issues related to the use of retaining wall river edge treatments.

Maintenance:

- Unlike many retaining walls, stacked stone is generally quite repairable if not mortared.
- Provided that a proper foundation is constructed and trees are prevented from growing too close to the wall, little maintenance should be required.


backslope planted with native riparian vegetation
2' to 5'typ. height of application above NWL
existing grade
stacked flat rock; mortar or dry-laid
river channel
footing

2. River Edge Treatment - Stone Toe Protection

Stone or cobble trenched and embedded into the toe of the riverbank serves as a foundation for the slope above, as well as armor against erosion. The interstitial spaces between stones can be planted with emergent vegetation to soften the appearance and increase water quality and habitat benefits. The height of the stone should be sufficient to address wave energy where this is a significant concern. Once well vegetated and weathered, the stone is not readily visible and has a relatively natural appearance. Once the slope is reestablished, it should be seeded, covered with erosion control blanket, and planted with plugs as necessary.

A variation on the stone toe protection concept are A-jacks, or other similiar prefabricated concrete structures. A-jacks are approximately 2 feet square concrete structures with a similar appearance to a toy jack. They are nested together to form a flexible foundation to provide toe protection. Due to their shape and the interlocking of the individual jacks, A-jacks are extremely stable. A-jacks can be seen at Kiwanis Park and Northside College Prep. High School.

This method can offer some cover habitat for macroinvertebrate and small fry fish. This can be important where the majority of the bottom is silty and devoid of macroinvertebrate habitat. Although the emergent zone is narrow, this may provide some foraging habitat opportunity for macroinvertebrate, small fish, and wading birds.

Advantages:

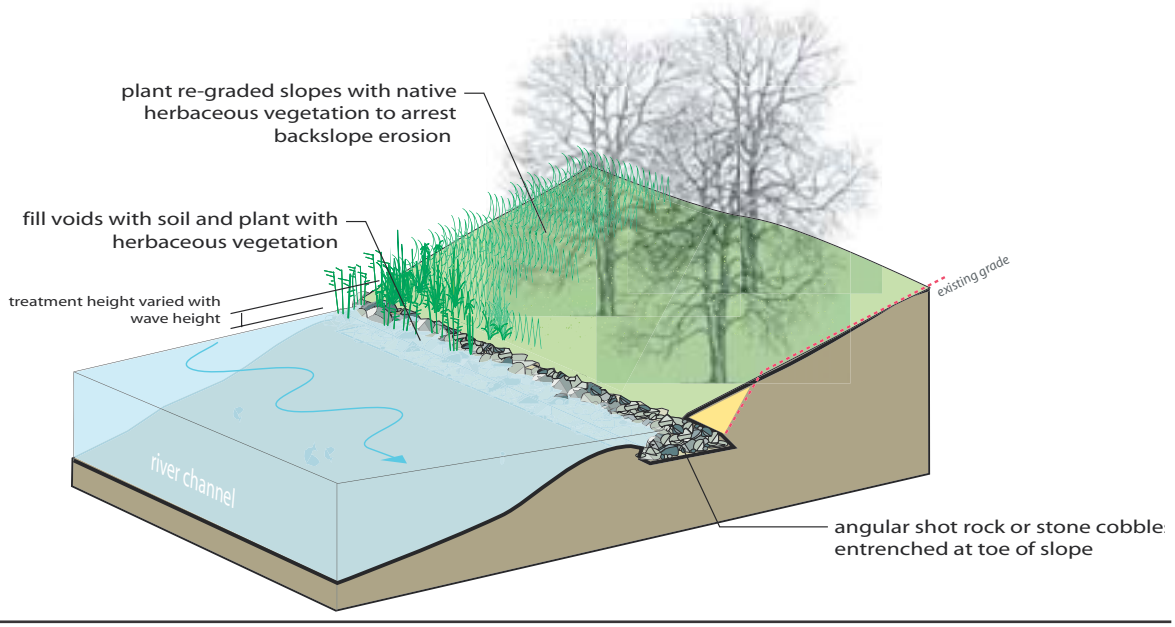
- Very effective method of toe stabilization where wave heights/water do not exceed height of stone. A-jacks are very stable and can resist high stream velocities and continuous wave action.
- Can be placed with minimal disturbance to the upper slope but must be trenched into the bed of the stream to provide slope stability and improve longevity.
- Gaps between larger stone can be interplanted with vegetation.
- Provides a flexible structure that can withstand modest movement without failure.
- A-jacks are quite resistant to vandalism.
- Provides some cover habitat for macroinvertebrate and small fry fish.
- Cost effective method where hard toe stabilization is required.

Disadvantages:

- A-Jacks are more expensive than stone and their installation is relatively specialized.
- Stone may be subject to vandalism. (Throwing of stones into the river)
- Stone may be considered unaesthetic in some locations, especially if large stone is required or the stone is not interplanted with native vegetation. Aesthetic qualities of A-jacks may be more of a concern than for stone.
- Although stone and A-jacks allows for a modest emergent edge, the emergent zone is quite narrow.

Maintenance:

- Little maintenance needed other than periodic inspection and repair if rocks have been moved. Repairs are relatively easy.
- A-Jacks are less likely to require periodic repairs but it is difficult to replace individual jacks due to the interlocking nature.


plant re-graded slopes with native herbaceous vegetation to arrest backslope erosion
fill voids with soil and plant with herbaceous vegetation
treatment height varied with wave height
existing grade
river channel
angular shot rock or stone cobble entrenched at toe of slope

3. River Edge Treatment - Gabion Basket or Mattress

Gabions are rectangular baskets or mattresses made from galvanized wire mesh that are filled with small to medium size stones. Gabions are tied together and placed at the bed/bank interface for immediate riverbank stabilization. Soil can be used to fill the void space and planted with vegetation to soften their appearance and improve water quality and habitat. Once the slope is reestablished, it should be seeded, covered with an erosion control blanket, and planted with native plugs as necessary. Gabion baskets can be found in Legion Park north of Bryn Mawr Avenue.

If gabion baskets or mattresses are planted with native herbaceous vegetation, this treatment will provide similar habitats as the stone toe protection treatment. There would be potential cover habitat for smaller organisms, and some foraging opportunities for macroinvertebrate and small fish. The wire baskets may deter usage of this area by shore birds.

Advantages:

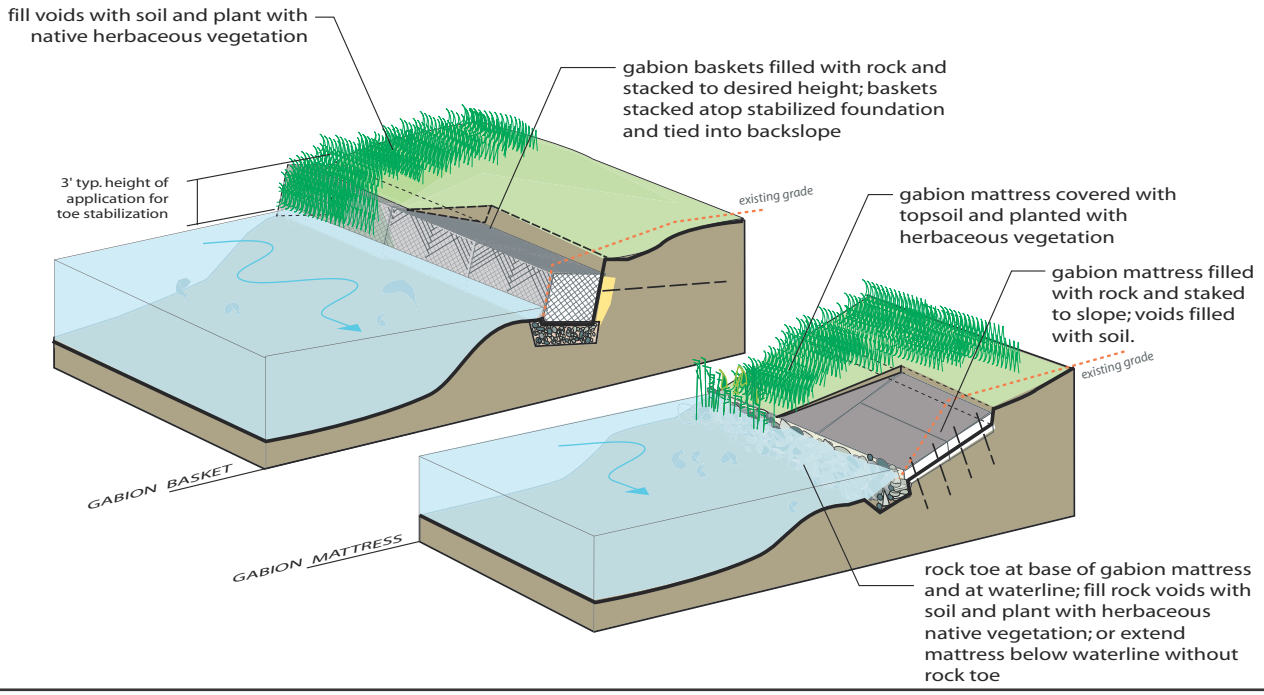
- Allows use of smaller stone than stone toe protection method for a given level of erosive pressure. Cost effective structural solution if required rock size is greater than what is locally available.
- Can provide a significant foundation for the upper slope.
- Because the baskets form a vertical wall, gabions can be used to fill a larger vertical cut.
- Gabions are conducive to vegetative growth if they are filled with soil.
- Gabion mattresses can be tailored to irregular shapes, e.g. transitions from one type of treatment to another, around drains, and other structural features.
- Provides some cover habitat for macroinvertebrate and small fry fish, especially when combined with native vegetation.
- Provides a semi-flexible structure that can withstand modest movement without failure.

Disadvantages:

- Tends to transmit flow and reflect wave energy (although not as severely as smoother walls such as sheetpile).
- Expensive to install and replace.
- Subject to vandalism.
- Wire mesh subject to sediment, ice abrasion and extremes in water pH that may lead to corrosion.
- Slope stability protection can be lost when damaged.
- Aesthetically unpleasing when not vegetated.
- Requires a stable foundation.
- Care must be taken during filling and complete lacing of the mattress components, which can be costly.
- Less flexible than stone toe.
- There may be significant wetland and floodway permitting issues related to use of gabion mattress treatment.

Maintenance:

- Wire mesh may need to be replaced.
- Periodic inspection to see if gabions have subsided.


fill voids with soil and plant with native herbaceous vegetation
gabion baskets filled with rock and stacked to desired height; baskets stacked atop stabilized foundation and tied into backslope
3' typ. height of application for toe stabilization
existing grade
gabion mattress covered with topsoil and planted with herbaceous vegetation
gabion mattress filled with rock and staked to slope; voids filled with soil.
existing grade
GABION BASKET
GABION MATTRESS
rock toe at base of gabion mattress and at waterline; fill rock voids with soil and plant with herbaceous native vegetation; or extend mattress below waterline without rock toe

4. River Edge Treatment - Sheetpile (low wall)

Often made from steel, sheetpile is an effective toe protection method, especially in deep-water situations. When used for river edge protection, only a low sheetpile wall is necessary to provide a foundation for the upper slope and protect against scouring. It can also be placed below water level so that it is not visually intrusive, but the protection from scour may be lost. When capped, it offers a seating and walking surface at the water's edge that accommodates walkers, anglers, and others. Once the slope is stabilized, it should be seeded, covered with an erosion control blanket, and planted with native plugs as necessary. Sheetpile can be seen at Ping Tom Park.

Advantages:

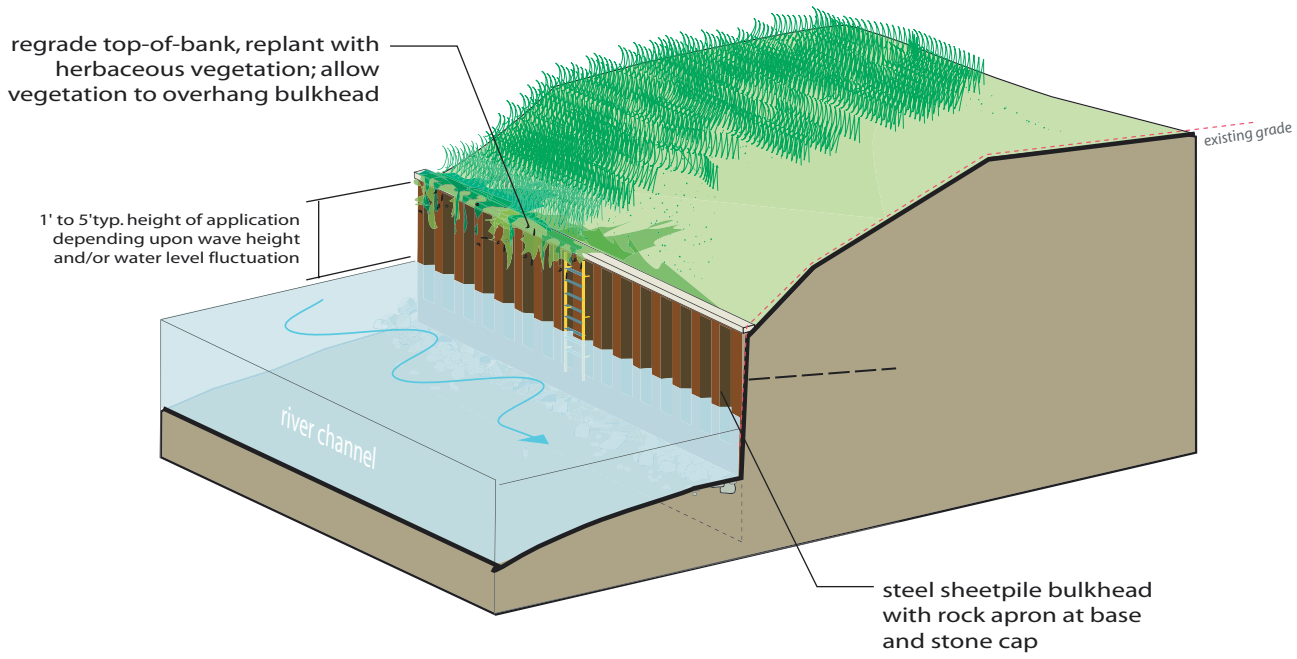
- Properly installed sheetpile is one of the most effective and long-term stabilization treatments.
- Opportunity to provide public access to the water's edge (fishing, walking, etc) when capped at an adequate width for pedestrians.
- Can be used for deep water application.
- Can be used above or below normal water level.
- When height is limited and there is a vegetated slope above, sheetpile can be nearly invisible from the land side of the wall.

Disadvantages:

- Most expensive river edge treatment method.
- Difficult and expensive to repair.
- Visually sterile.
- Provides virtually no aquatic habitat for fish and other wildlife.
- Stone apron is needed to prevent scour and undermining, particularly where there is significant wave energy.
- Transmits or reflects flow and wave energy downstream.
- There may be significant wetland and floodway permitting issues related to the use of sheetpile.

Maintenance:

- Very little maintenance is required.
- Periodic inspection to evaluate and address scouring.


regrade top-of-bank, replant with herbaceous vegetation; allow vegetation to overhang bulkhead
existing grade
1' to 5'typ. height of application depending upon wave height and/or water level fluctuation
river channel
steel sheetpile bulkhead with rock apron at base and stone cap

5. River Edge Treatment - Fiber Roll

A fiber roll is a cylinder of nonwoven fibers made from compacted coconut husk fiber, and wrapped within a coir woven mesh rope or coconut fiber mesh. Fiber rolls are available in varying diameters and lengths. Installation of the fiber rolls occurs in a linear fashion along the toe of eroding streambanks to prevent erosive flows or wave energy from directly contacting the toe of the bank. The rolls are staked into place and planted with appropriate native wetland plants. The long-term stabilization is dependent upon extensive establishment of the vegetation as the fiber roll slowly biodegrades. Site conditions that need to be considered include: hydrologic regime – one that provides adequate flow to sustain the vegetation, but without excessive velocities or flood durations that exceed the plant's flood tolerance; expected sediment load – excessive loads may limit ability to establish vegetation at the water's edge; shade conditions; and substrate stability – noncohesive material such as sand or silt may require longer or more frequent staking to provide secure anchoring. Once the slope is reestablished, it should be seeded, covered with an erosion blanket, and planted with plugs as necessary.

In several past applications, the planting embedded in the fiber roll that occurred at the time of installation did not survive due to the relatively sterile and dry conditions within the fiber roll. In those same applications, a second planting that occurred after the roll had become silted was quite successful as the accumulated silt provided a better growing medium and helped retain moisture within the roll. The narrow bank of emergent habitat provides cover, resting, and foraging opportunities for macroinvertebrate, small fish species, and wading birds.

Advantages:

- Provides short-term stabilization (~5-year) and a medium to establish desirable emergent and riparian vegetation that provides long-term stabilization.
- Flexibility for molding to the existing curvature of riverbank.
- Provides toe protection where scour is not severe and vegetation is sufficient to provide long-term stabilization.
- The established vegetation provides some water quality and aquatic habitat benefits and a natural looking river edge.

Disadvantages:

- Limited effective life – biodegrades in 3-5 years. If vegetation is not sufficiently established by this time, the treatment may fail.
- Requires maintenance to ensure establishment of vegetation, including replanting, etc. during the establishment period.
- Not appropriate for sites with severe scouring, high velocity flows, or large ice build-up. On the Chicago River, applications may be limited to use within created backwater areas (see treatment 6).
- There must be sufficient sunlight available for colonizing plant growth.
- Should only be installed in areas with low flow velocities, relatively stable substrates, and where erosion pressure is low and vegetation can be established.

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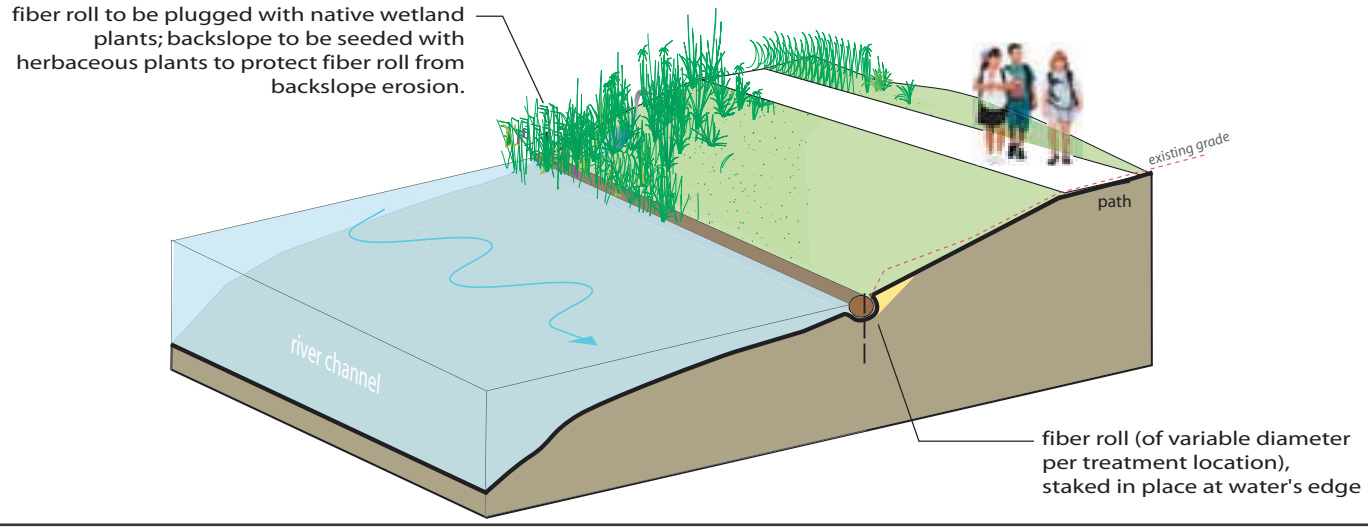
Maintenance:

- Periodic inspections of the coir roll will need to be undertaken to ensure stability as well as assess the establishment of native vegetation, which is critical as the fiber roll degrades.
- Plant maintenance will consist of invasive species removal, and other natural area management techniques as necessary to maintain appropriate emergent plantings.


fiber roll to be plugged with native wetland plants; backslope to be seeded with herbaceous plants to protect fiber roll from backslope erosion.
existing grade
path
river channel
fiber roll (of variable diameter per treatment location), staked in place at water's edge

6. River Edge Treatment - Floodplain Wetland/ Aquatic Shelf

This treatment involves cutting back the existing bank to create a shallow aquatic shelf that would support native emergent and aquatic vegetation. The newly created slope should be planted with native riparian vegetation. Applicability of this treatment is limited to areas with sufficient space to allow grading the banks back a sufficient distance to create a shallow shelf. The width of the shelf could be a little as 5 feet or as great as 50 or more feet to create a backwater "slough." This treatment can significantly increase aquatic and riparian habitat. With adequate width and vegetation establishment, flow and wave erosion pressure at the water's edge can be substantially reduced. However, it may be necessary to provide some level of hardened stabilization at the edge of the channel (but below the normal water level). The reestablished slope should be seeded, covered with an erosion control blanket, and planted with native plugs as necessary.

The establishment of different plant communities along the hydrologic gradient (e.g., permanently inundated to saturated soil conditions), provides the chance for a diversity of vegetative species. This in turn provides the opportunity for a diversity of fauna species within the varied microclimatic habitats. For example, a backwater slough habitat would provide refuge for fish during storm events and this area may be inundated after storm events for a sufficient time period to provide amphibian and small fish habitat. This will then provide foraging opportunities for wading birds and some mammals (e.g., raccoons). Later in the season when the slough area becomes a mud flat, this will provide a different foraging niche for sandpiper and similar shore bird species. The width of created wetland habitat will determine the various usages of the habitat; less width will provide some cover and foraging opportunities; more extensive width (50 feet or greater) will provide better cover, more foraging opportunities, and potential for nesting habitat.

Advantages:

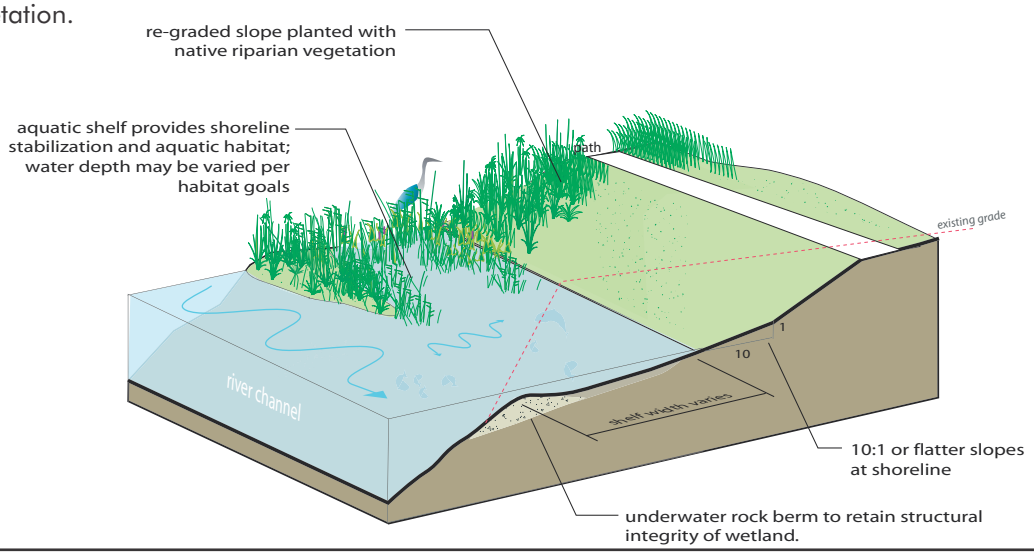
- If properly integrated into the river edge and adjacent landscape, floodplain wetland/aquatic shelf can provide long term stabilization of the shoreline.
- Creates excellent wetland and aquatic habitat for a variety of aquatic wildlife.
- Elevation of the shelf relative to normal water level and the degree of direct connection with the river can be varied to achieve different plant community and habitat goals.
- The river is extended into the park enhancing the aesthetics of both the river and the park.
- Provides additional opportunities for environmental interpretation and programming.

Disadvantages:

- Adequate landward space is required to create the shelf and the back slope.
- Depending on the height of bank, the amount of material to be removed may be very large, therefore costly.
- Excessive silt deposition could limit plant communities that can be established.
- Requires commitment during vegetation establishment period.
- Long-term commitment for monitoring and management.

Maintenance:

- Interface between shelf and channel will need to be inspected for scouring.
- Routine management of plant communities, typical of other created wetlands, including control of invasive vegetation and burn management.
- Replacement of lost vegetation.


re-graded slope planted with native riparian vegetation
aquatic shelf provides shoreline stabilization and aquatic habitat; water depth may be varied per habitat goals
existing grade
1
10
river channel
shelf width varies
10:1 or flatter slopes at shoreline
underwater rock berm to retain structural integrity of wetland.

1. Slope Treatment - No Grading

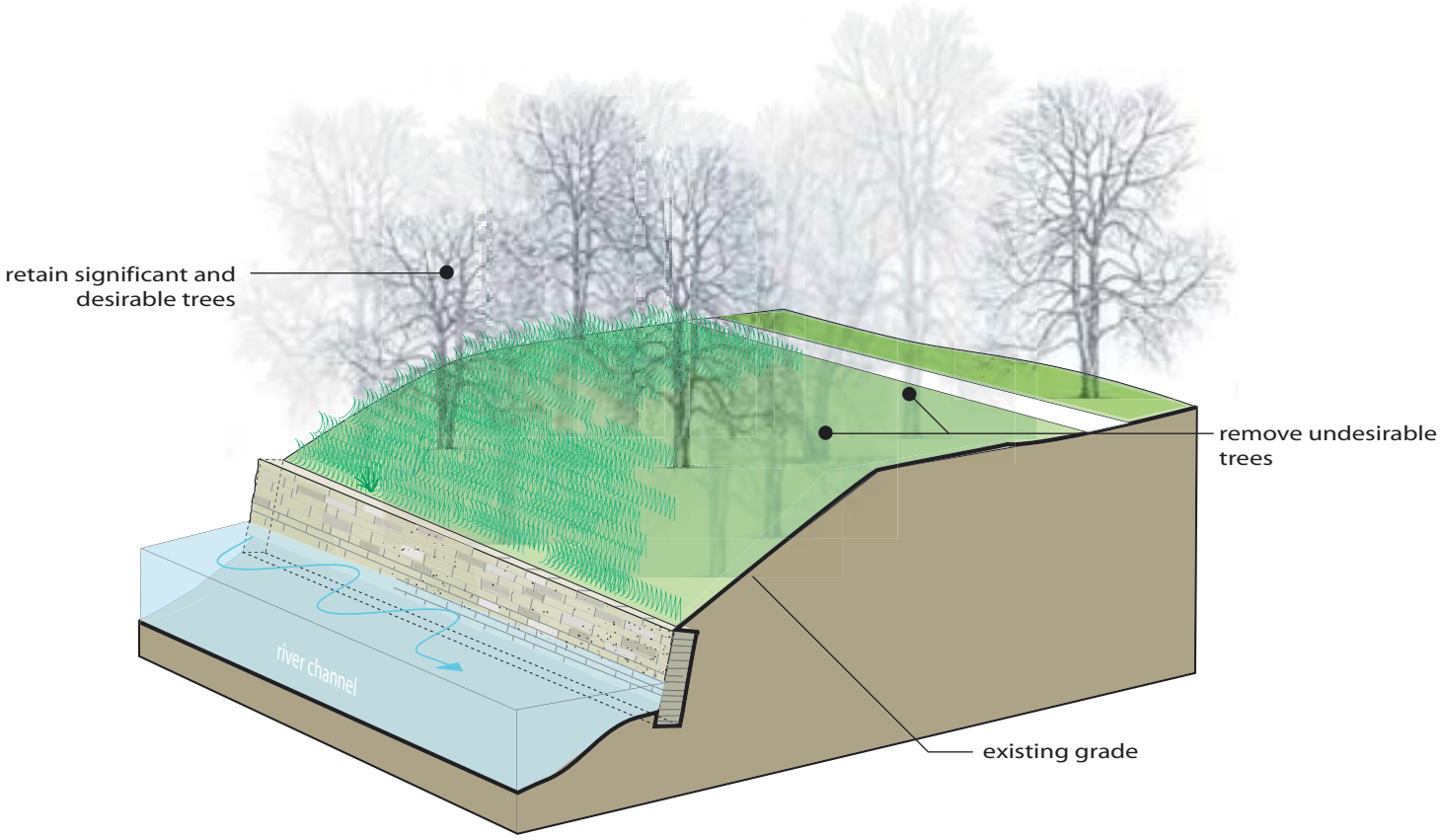
In many areas, the bank slope is relatively stable; therefore, no regrading of the slope is necessary. However, there are areas where dense growth of invasive trees and shrubs with insufficient groundcover is leading to surface erosion. Tree canopy should be selectively thinned to allow sunlight in order to establish native riparian cover to address surface erosion.

The reestablishment of a native vegetative cover, which is primarily native grasses and forbs, will provide cover habitat and a food source for small mammals and birds, as well as a breeding habitat and food source for insect species. If native shrub species are interplanted within the "prairie" or "savanna" communities, this will provide an additional layer of structure for breeding, foraging, and cover opportunities for wildlife.

Advantages:
- No major site disturbance – allows retention of existing desirable trees.
- Vegetative management creates an environment for native plant growth and wildlife.

Disadvantages:
- Where slopes are relatively steep but stable, access down to the water may be limited.
- Success of long term slope stability may be dependent upon vegetative establishment.
- Establishment of vegetation may be difficult on steep, shaded and north facing slopes.
- Where slopes are steep and high, toe stabilization is critical to maintain slope stability.

Maintenance:
- Burn management is recommended for establishment of a native vegetative community.
- Initial establishment period (years 1 – 3) would require more intense weed control via mowing or string trimmer, herbicide treatment, etc. for control of weedy and undesirable non-native species.



Note: The "no grading" slope treatment is shown with "stacked flat rock" toe stabilization.

2. Slope Treatment - Regrading

Where bank slopes are steep and unstable, regrading may be required. In most cases, regrading will require partial or complete removal of existing vegetation (trees and other vegetation). This provides an opportunity to plant more desirable riparian tree species and native vegetation. The establishment of deep rooted native herbaceous plant communities on the regraded slopes is necessary to prevent soil erosion. Erosion blankets must be used to provide temporary protection against sheet and rill erosion and to facilitate vegetative establishment.

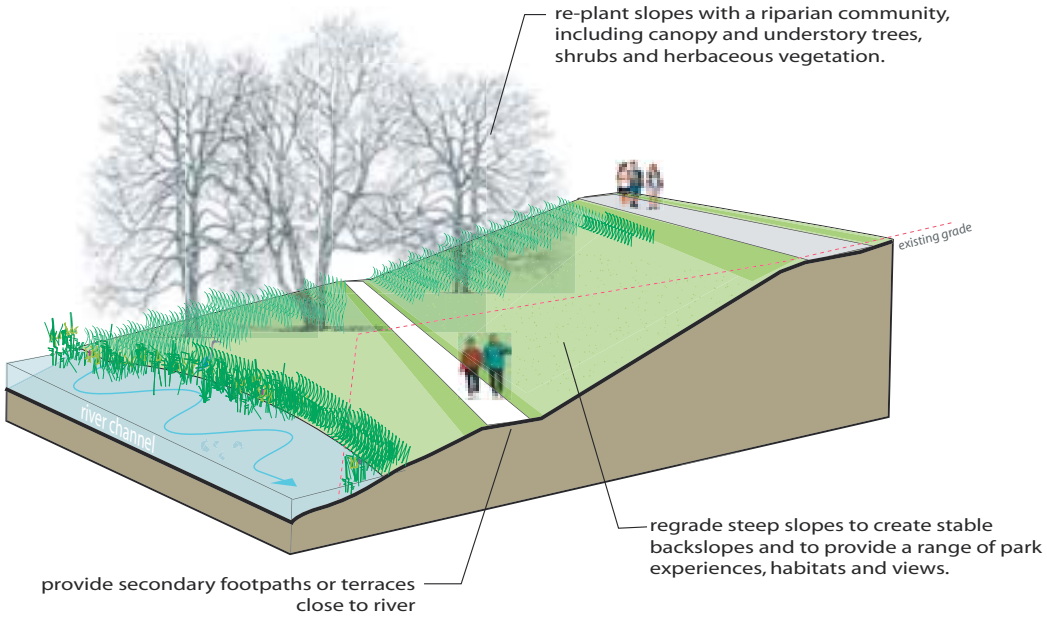
The potential wildlife habitat for this treatment would be similar to the no grading treatment option (if native communities are reestablished under that treatment application). However, this treatment, may create a wider habitat depending upon the extensiveness of the proposed grading. Development of a wider habitat provides increased potential of breeding conditions for some bird and small mammal species. For example, data collected of minimum riparian buffer strip widths required to support breeding bird populations in Iowa resulted in more generalist species such as cardinal, black-capped chickadee, and downy woodpecker requiring buffer widths of 11 to 15 meters. Mid-range buffer widths of 35 to 90 meters supported bird species such as great crested flycatcher, hairy woodpecker, and red-eyed and warbling vireos. More substantial buffer widths, 150 to 200 meters, are needed for more specialist species such as blue-gray gnatcatcher, ovenbird, and scarlet tanager.*

Advantages:
- Structures not needed to stabilize slopes, providing a natural appearance.
- Immediate solution, creates “clean template” to established desired plant communities and provides appropriate slopes minimizing erosion problems.
- The establishment of native vegetative communities provides wildlife habitat opportunities and creates a pleasing aesthetic.

Disadvantages:
- Usually requires removal of many or all existing trees, shrubs, and other vegetation, which creates a temporarily barren landscape.
- Establishing trees and herbaceous vegetation is necessary.
- Requires room to perform regrading.

Maintenance:
- Routine inspection of new vegetation establishment.
- Invasive species control including but not limited to burn management, mowing, string trimmer, herbicide treatment, etc.
- Replanting and reseeding as necessary.

* Reference: Fischenich, J.C. and Copeland, R.R.(2001). “Environmental considerations for vegetation in flood control channels,” ERDC TR-01-16, U.S. Army Research and Development Center, Vicksburg, MS.


re-plant slopes with a riparian community, including canopy and understory trees, shrubs and herbaceous vegetation.
existing grade
river channel
regrade steep slopes to create stable backslopes and to provide a range of park experiences, habitats and views.
provide secondary footpaths or terraces close to river

3. Slope Treatment - Retaining Walls

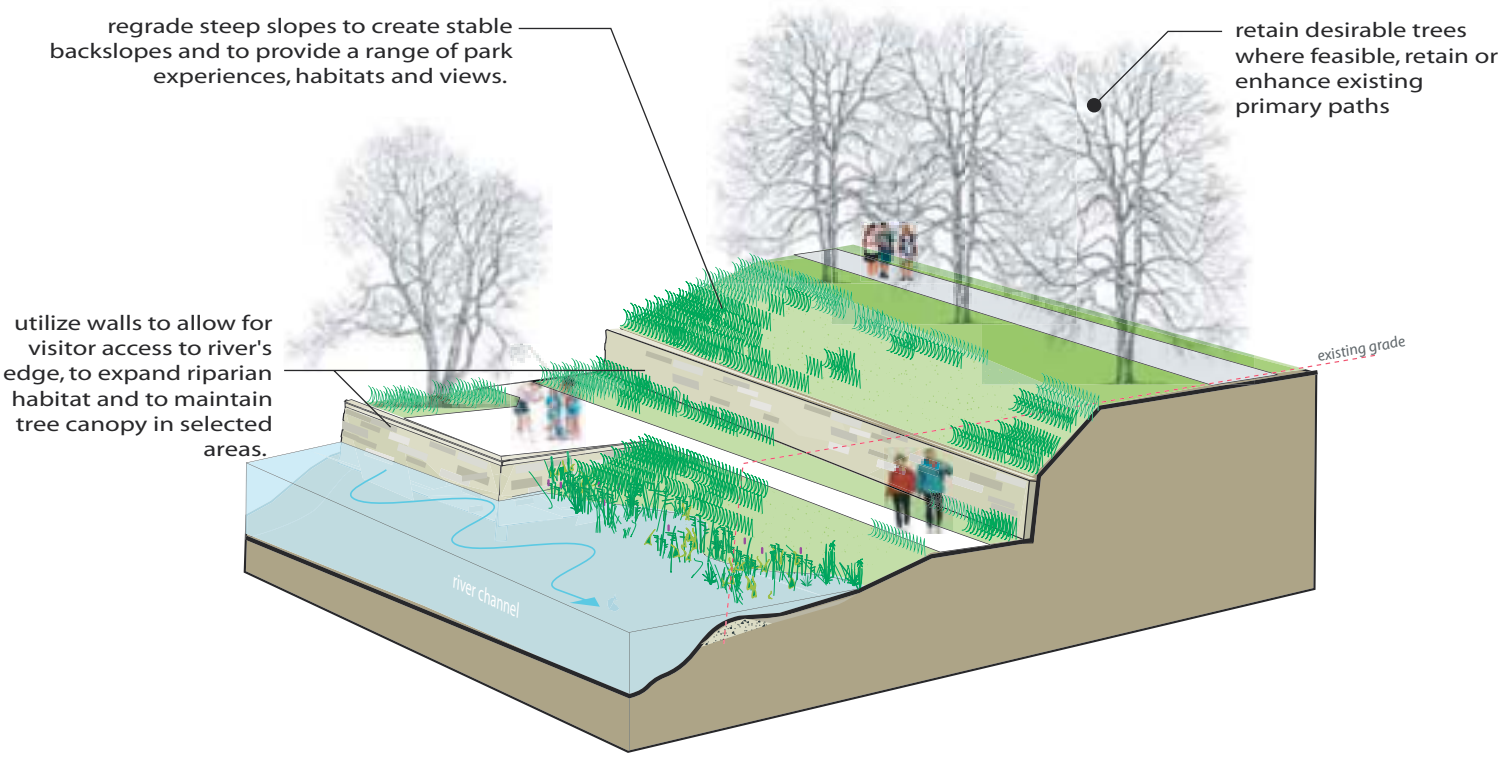
Retaining walls stabilize the slopes by retaining the soil behind them. The wall can be made from a variety of durable materials such as sheetpile, timbers, stacked rock, poured concrete, stone or gabions. Retaining walls can be located at the river edge where they can be an extension of a wall or can be placed back from the river edge to allow for a trail or other uses between the edge and the back slope. Also, the materials selected can impact the the aesthetic of the wall.

This treatment type does not provide any habitat benefits.

Advantages:
- Can be placed at shoreline or further landward to accommodate trails and amenities.
- Provides access to water's edge.
- Presents opportunity to integrate overlooks, steps to the river, and other amenities in an artful way.

Disadvantages:
- There may be significant floodway permitting issues where the retaining wall is used to reduce the cross-section of the channel.
- Retaining walls are generally the most expensive means of slope stabilization
- Retaining walls tend to isolate the river from its corridor and associated habitat.

Maintenance:
- Periodic inspection for tipping and buldging.
- Possible vandalism where the wall is constructed of movable material (stacked stone, gabions, etc).


regrade steep slopes to create stable backslopes and to provide a range of park experiences, habitats and views.
retain desirable trees where feasible, retain or enhance existing primary paths
utilize walls to allow for visitor access to river's edge, to expand riparian habitat and to maintain tree canopy in selected areas.
existing grade
river channel

Note: The "retaining wall" slope treatment is shown with "retaining wall and wetland fringe" toe of slope treatments.

4. Slope Treatment - Compacted Soil Lifts

Soils lifts are typically used to reconstruct failed slopes and allows for the creation of steeper slopes than would normally be feasible with regrading alone. This slope treatment consists of fabric reinforced soil lifts (compacted layers) seeded and planted with native vegetation. Compacted soils lifts are generally installed with a stone toe or A-jacks to provide a foundation and toe protection. The stone provides a drainage layer to reduce the duration of saturated bank conditions that can lead to bank slumping. The fabric provides temporary stability and protection from erosive forces before the native vegetation can become established and provide long-term stability.

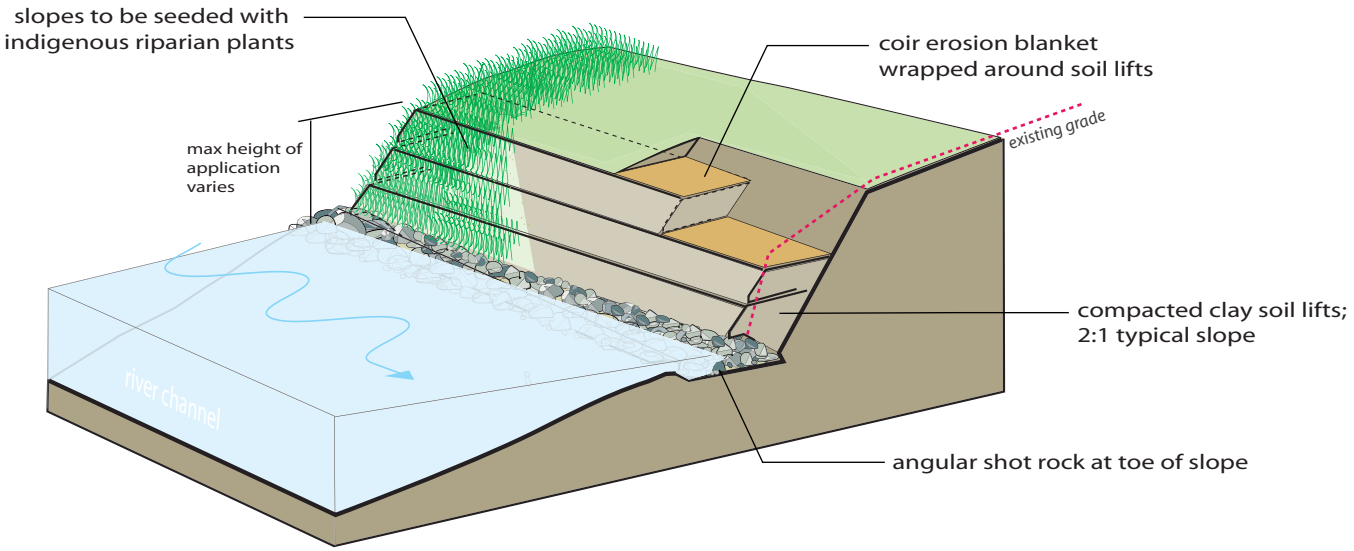
In many applications, the soil lifts are constructed in the location of a former slump to replace lost bank material and reestablish a continuous slope along the reach. In other applications, compacted soil lifts may be used where bank regrading is not an option due to space constraints.

This treatment would provide some potential cover and foraging habitat opportunities similar to the "no grading" alternative. However, due to the steeper gradient of this treatment, it would be more limiting for wildlife usage. This method of stabilization would most likely be used in limited scenarios such as a bank "blowout" due to lateral runoff, and the application of the treatment would not be widespread.

Advantages:
- Can be used on steeper and higher banks than the regrading option.
- Can be used to rebuild bank slope where soil has slumped away.
- Creates environment for native plant growth and wildlife habitat.

Disadvantages:
- More expensive than regrading.
- May require importing of suitable soils if existing material is unsuitable for bank stability.
- For successful treatment, this technique must be combined with the stone toe or other hardened shoreline treatment.
- System must be built during low flow conditions.
- Erosion blanket biodegrades in 5-7 years.

Maintenance:
- Vegetative management during the vegetation establishment period.
- Periodic inspection to identify and address evidence of slope failure.


slopes to be seeded with indigenous riparian plants
coir erosion blanket wrapped around soil lifts
existing grade
max height of application varies
compacted clay soil lifts; 2:1 typical slope
river channel
angular shot rock at toe of slope

Note: The "compacted soil lifts" slope treatment is shown with "stone toe" toe stabilization.

5. Slope Treatment - Rip rap

This treatment involves layered angular stone that protects and stabilizes banks that are subject to erosion within areas of poor soil structure. The stone should be underlain by a filter blanket of gravel or synthetic material to prevent migration of soil through the rip rap.

The voids in the rip rap may be filled with soil and interplanted with vegetation to soften the appearance and improve habitat and water quality benefits. Although a portion of the soil may erode away over time, the rip rap prevents the bank from receding further and the vegetation will tend to mask the rock. This variation rip rap is similar to vegetated gabions.

Advantages:

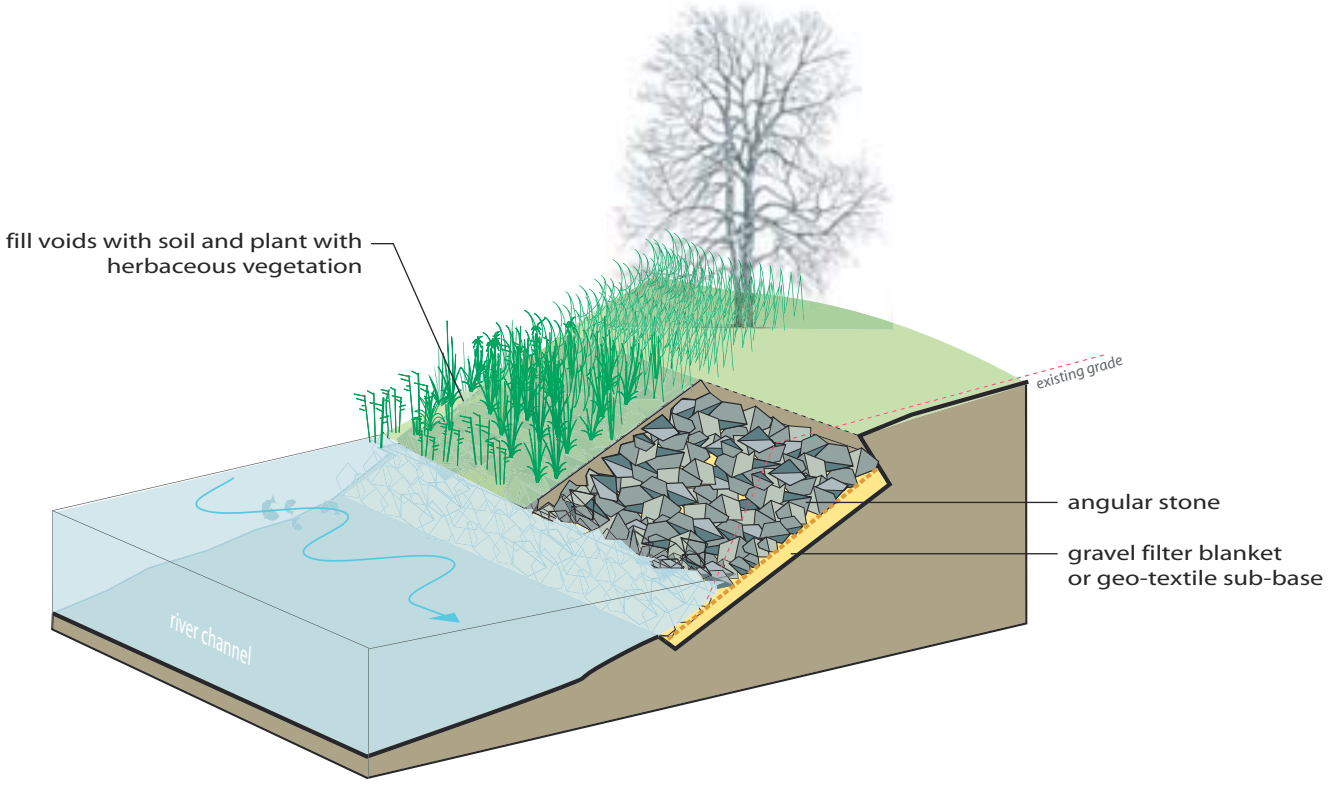
- Well suited for locations of high flow or wave energy that impinges higher on the slope than toe protection measures. Examples include locations of large waves and large water level fluctuations.
- Can be used to protect steeper slopes where regrading to relieve flow or wave energy is not feasible.
- Can appear quite natural when layered with soil and vegetation.

Disadvantages:

- May be considered unaesthetic in some locations, especially if unable to be interplanted with native vegetation.
- Limited wildlife habitat opportunities when not layered with soil and vegetation.
- Moderately expensive although less than retaining walls.
- Potential for vandalism. Stone can be thrown into river.

Maintenance:

- Low maintenance required; periodic inspections to assess if rocks have subsided.


fill voids with soil and plant with herbaceous vegetation
existing grade
angular stone
gravel filter blanket or geo-textile sub-base
river channel

Treatment Summary Matrix

		Application				Environmental Benefits						Cost Considerations		
	Treatment	Tolerate large water level fluctuation	Tolerate high flow velocity	Tolerate high wave action	Ability to accommodate amenities (trails, etc)	Fish habitat	Small fry fish habitat	Macro-invertebrate habitat	Soil Stabilization	Improve Water Quality*	Dissipates flow/wave energy	Installation Cost	Longevity**	Maintenance
Shoreline	Stacked Flat Rock	X	X	X	X		X	X	X			M-H	H	L
	Stone Toe Protection	X	X	X	X		X	X	X			L	H	M
	Gabion Basket or Mattress	X	X	X	X		X	X	X			M	M	M-H
	Sheetpile	X	X	X	X				X			H	H	L
	Fiber Roll				X		X	X	X	X	X	L	L	H
	Floodplain Wetland /Aquatic Shelf		X	X	X	X	X	X	X	X	X	L-H	H	M
	Lunkers	X	X	X	X	X	X		X		X	M	M	M
Slope	No Grading	X				-	-	-	1	1		L	L-H	M-H
	Regrading	X			X	-	-	-	X	X	X	M-H	M-H	M-H
	Retaining Wall	X	X	X	X	-	-	-	X			H	H	L
	Compacted Soil Lift	X	X			-	-	-	X	X	X	M	M	M
	Rip rap	X	X	X		-	-	-	X		X	M-H	H	L-M

* Improvement in water quality due to filtering of runoff from adjacent areas and/or flow river water. Improvement due to reduction in soil erosion of slope or toe addressed under "soil stabilization."

** Certain techniques longevity such as fiber roll, aquatic shelf and compacted soil lift depend on continual maintenance.

1. No grading treatment will only provide soil stabilization and water quality benefits if the existing slope is stable and vegetation is managed to achieve good herbaceous cover.

L = Low
M = Medium
H = High

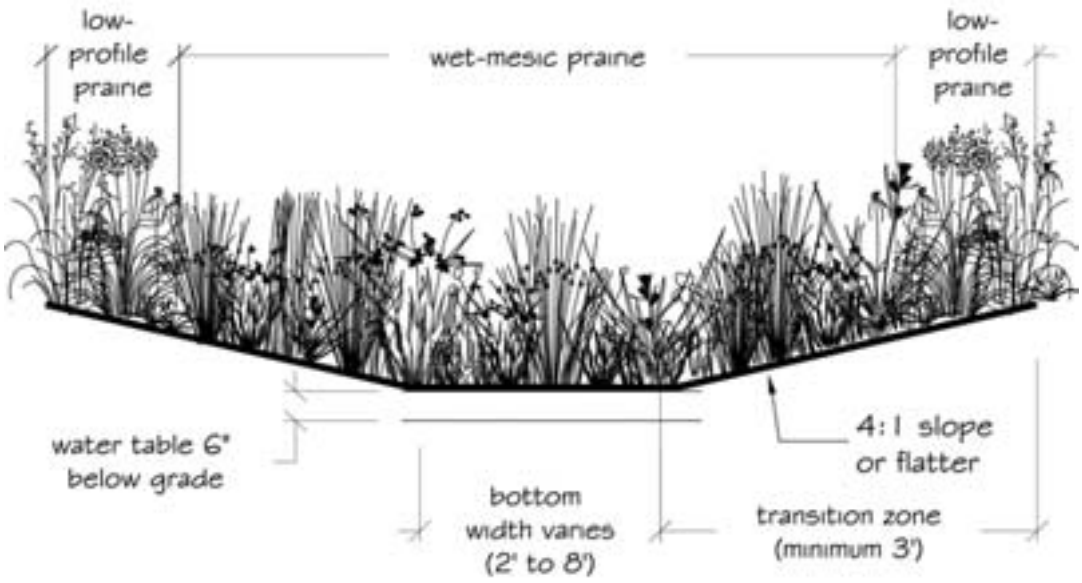
Appendix L: Stormwater Best Management Practices

The following are stormwater best management practice stormwater systems and maintenance protocols that can be utilized on the river setback area (source: City of Chicago Calumet Design Guidelines 2004).

Stormwater Systems - Best Management Practices

Vegetated Swales

A vegetated swale is an open system that is used to slow runoff and filter sediments and pollutants. It is used instead of conventional piping to contain and convey stormwater. Depending on the depth of the water table, the swale may be wet, wet-mesic or well-drained. On-line detention can be augmented by using check dams. Maximum efficiency for water quality enhancement can be achieved by lengthening the channel and/or minimizing its gradient.



Design Objectives:

- Slow conveyance of stormwater runoff.
- Facilitate the removal of pollutants and the assimilation of organic nutrients by vegetation.
- Encourage surface water infiltration (where soils permit).
- Provide an aesthetically pleasing landscape feature.

Considerations:

- Vegetated swales should be at least 20 feet wide, and designed with slopes that do not exceed 4:1 **(**see Figure V-11).
- The design of the landscape within a vegetated swale will depend upon:
  - Its location and function.
  - Soil permeability.
  - The depth to water table.

- An erosion control blanket will be required for slopes that are steeper than 5:1. Slopes that are 5:1 or less can be stabilized by vegetation and mulch (see Section VI, Specifications).

- The water level in the swale will fluctuate. Plant mixes presented below have been developed to tolerate the two-year and ten-year storm events.

Design Standards:

- Develop swales with slopes that are 4:1 or flatter.
- Install mixes in appropriate zones (see Figure V-11).

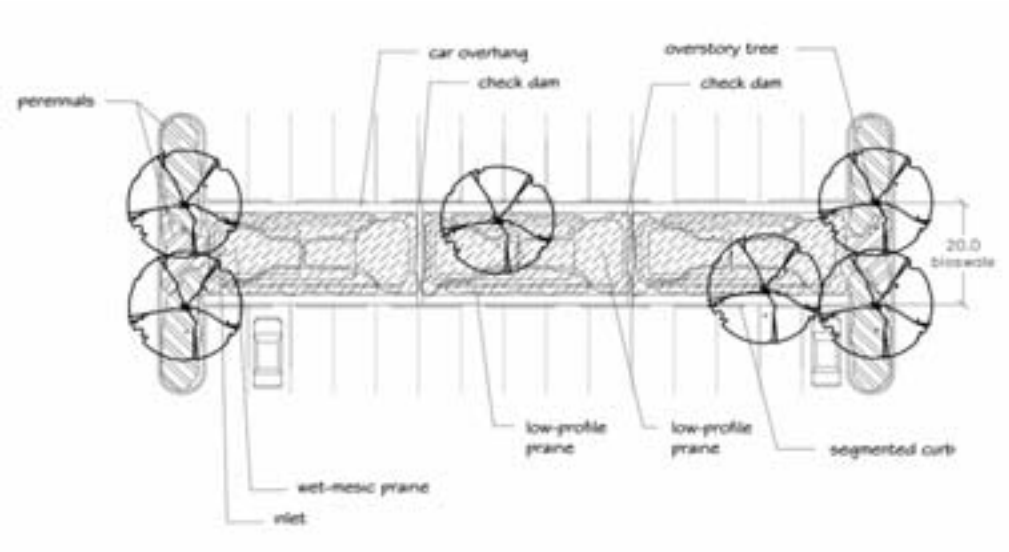
Planting Recommendations:

Components	Plant Community	Design Standards
Well-Drained Swale	Low-Profile Prairie, Mix #3	Seed: 47.7 lbs. per acre Plugs: 50.0 per acre, 18" o.c. (avg.)
Wet-Mesic Swale		
Slopes above 2-year event	Low-Profile Prairie, Mix #3	Seed: 47.7 lbs. per acre Plugs: 50.0 per acre, 18" o.c. (avg.)
Bottom	Wet-Mesic Prairie, Mix #2	Seed: 39.7 lbs. per acre Plugs: 4850 per acre, 18" o.c. (avg.)
Wet Swale:		
Slopes above 2-year event	Low-Profile Prairie, Mix #3	Seed: 47.7 lbs. per acre Plugs: 50.0 per acre, 18" o.c. (avg.)
Waterline (NWL to 2-year event)	Wet-Mesic Prairie, Mix #2	Seed: 39.7 lbs. per acre Plugs 4850 per acre, 18" o.c. (avg.)
Bottom (NWL to 6" below NWL)	Emergent Marsh, Mix #3	Seed: 8.8 lbs. per acre Plugs: 4825 per acre, 18" o.c. (avg.)

Bioswales

Bioswales are recommended for use in parking lots as a way to replace curbed, landscaped medians with an option that assists in stormwater management. A bioswale is a lightly excavated swale where the grade is a foot lower than surrounding pavement. Surface water enters the swale via openings in the curb, and then flows through a series of short pools created by low check dams. Water drains into a stormwater inlet and then flows though underground pipe to the next segment of the stormwater system. Bioswales can improve water quality through the removal of sediments and the assimilation of nutrients.

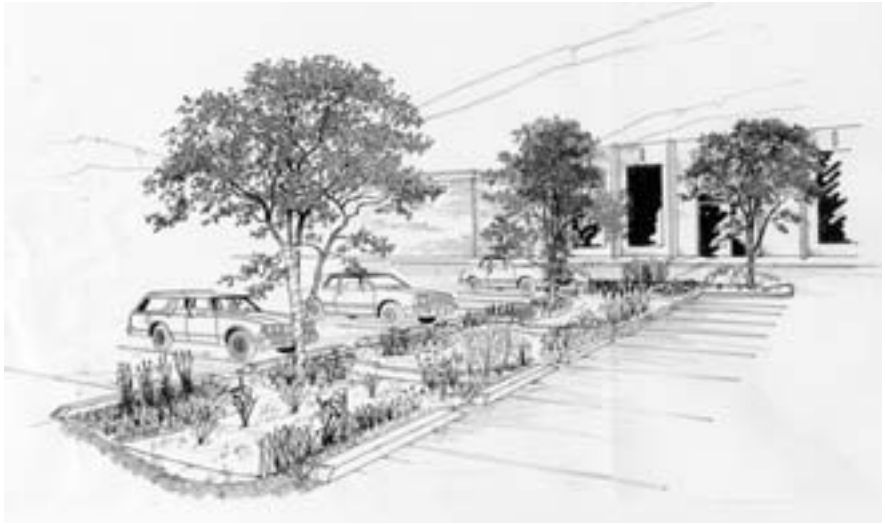
A bioswale can be planted with trees for shade, and with low-growing prairie plants that tolerate road salt. Plant choices may include decorative native grasses such as little bluestem and prairie dropseed, as well as flowers such as brilliantly orange butterflyweed or purple spiderwort. This creates an attractive first-impression for a business facility, as well as being a component of a stormwater management system.



Plants selected need to be adaptable to varying soil moisture regimens, depending on their location in the system. The success of a bioswale can be enhanced by seasonal flushing of salts and de-icing chemicals. This reduces the effects of accumulated salts or de-icing chemicals on plants in the spring that could stunt growth, or otherwise damage or destroy the landscape.

Design Objectives:

- Encourage the settling of particulates and associated pollutants from parking lots.
- Offer the opportunity for infiltration and the assimilation of nutrients by native plants.
- Help store and modulate conveyance of stormwater.
- Provide an aesthetically pleasing amenity in open parking lots that introduces seasonal color and interest through the planting of native flowering plants and perennials on the ends of islands.



Considerations:

- Snow should not be piled within these swales, but placed in other areas of the parking lots to minimize the leaching of salt or other chemicals into the bioswales.
- Sand or de-icing chemicals, such as calcium chloride, should be used instead of salt to maximize the success of the landscaping in these swales.
- A bioswale needs to have access to a water hookup or have an irrigation system installed to flush out chemical de-icing agents or salts in early spring.

Design Standards:

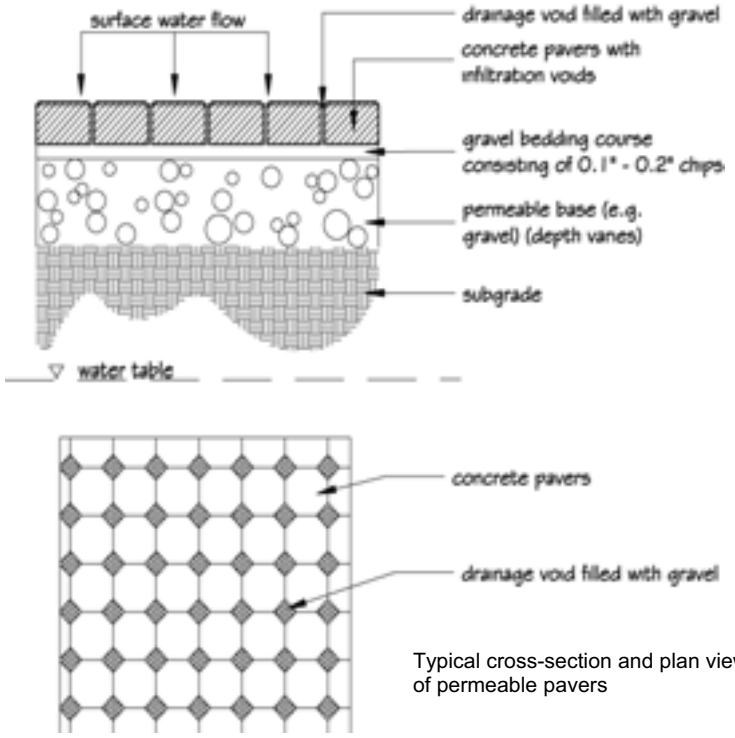
- Provide 20-foot wide bioswales within alternating parking modules (one bioswale every three rows.)
- Construct the bioswale with side slopes that are 3:1 or flatter.
- Create check dams with soil or other material (i.e., concrete, boulders, or masonry interlocking retaining wall system) every 50 feet.
- Construct a series of 9' long, 6" segmented barrier curb with 24" openings, along the length of the bioswale, between each segment.
- Install 24" of low-mow turf or other material acceptable to the City on the inside edge of the curbs to accommodate car overhang.
- Select plantings for conditions typical for each zone (i.e., dry, wet and fluctuating between dry and wet) from the plant lists identified below. Use native plants in the swale and, where possible, on the ends of each island.
- Use horticultural varieties of native plants on islands for longer-bloom times and more intense color. However, the designer is limited to the perennials list included in Appendix B for end islands of bioswales, to ensure landscapes are blended (native and ornamental).
- Install an erosion control blanket in the swale while vegetation is established.

Recommended Plantings:

Components	Plant Community	Design
Upper Slopes (next to pavement)	Low Profile Prairie #2	Plugs: 405/900 sq. ft., 18" o.c. (avg.)
	Overstory Trees, Woody Plant List #2	3" caliper, min. (6' branch ht.) 1 tree/45 lineal feet
Channel (below check-dam)	Low Profile Prairie #1	Plugs: 405/900 sq. ft., 18" o.c. (avg.)
Channel (above check-dam)	Wet- Mesic Prairie, Mix #5	Plugs: 405/900 sq. ft., 18" o.c. (avg.)
Island Termini	Perennials	1600/25 sq. ft., gal.containers 15" o.c. (avg.)
	Overstory Trees, Woody Plant List #2	3" caliper, min (6' branch ht.) 2 trees per island terminus

Permeable Pavers

Permeable pavers are interlocking concrete blocks set in a compacted sand or gravel base. The bed allows absorption of rainwater. When laid properly, with an appropriate depth of gravel, pavers can handle weight loads equal to or greater than those of asphalt or other conventional impermeable surfaces.


surface water flow
drainage void filled with gravel
concrete pavers with infiltration voids
gravel bedding course consisting of 0.1" - 0.2" chips
permeable base (e.g. gravel) (depth vanes)
subgrade
water table
concrete pavers
drainage void filled with gravel

Typical cross-section and plan view of permeable pavers

They can be used in parking lots, loading areas, and outdoor storage areas where no chemicals or other materials hazardous to the environment are stored. Their use is appropriate where a hard, paved surface is required and reducing stormwater runoff is desirable.

Pavers form a tight surface with narrow joints separating the pavers, and structured openings that are filled with permeable material, such as gravel. Approximately 10 to 12 percent of the surface area remains permeable, allowing rainwater to drain through the paved surface and into the subgrade material below. Depending on the nature of the soil on the site, water may infiltrate and contribute to groundwater recharge, or it may be discharged into other stormwater management facilities via underground drains.

The use of permeable pavers reduces runoff, providing some storage, and it improves water quality. Water that is discharged into other swales, ponds or basins is cooler and microbial action within the aggregate subgrade helps enhance water quality. Permeable pavers are marketed under several different names, but should not be confused with permeable pavements, which require resurfacing.

Permeable pavers can be:

- Plowed without damage to the paver surface.
- Painted to differentiate parking spaces.
- Color-coordinated to identify pedestrian walkways, parking spaces, or drive aisles.
- Used instead of concrete for private walks.
- Installed along the edges of drive aisles or parking lots to allow runoff or rain water to infiltrate into the ground.

Design Objectives:

- Provide a solid paved surface with high permeability for surface water (see Figure V-16).

- Create an aesthetic amenity on parking, loading, and driving surfaces.
- Offer opportunities for attractively distinguishing between functional areas and pedestrian ways, drive aisles and parking lots.

Considerations:

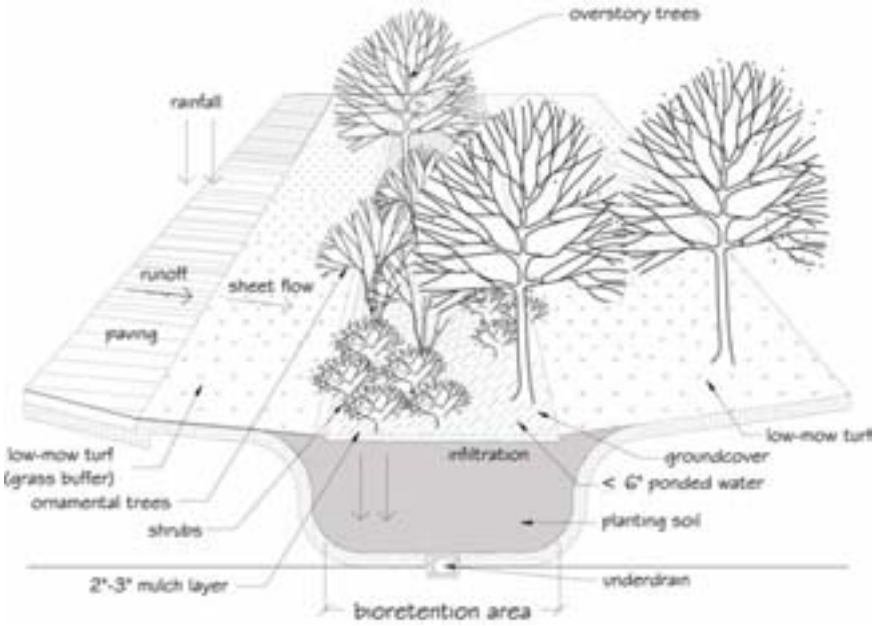
- Permeable pavers cost more to install than traditional asphalt pavements, though they last longer and do not require resurfacing.
- They require regular sweeping to remove debris from openings.
- They require periodic replacement or cleaning of the gravel filters to remove silt that can obstruct infiltration of water into the ground.

Design Standards:

- Consult paving manufacture for installation and maintenance specifications.
- Install pavers mechanically to achieve cost competitiveness with asphalt.

Bioretention Basin

A bioretention area is a depressional stormwater management facility that uses a conditioned soil, mulch and plant matrix to collect, and infiltrate stormwater (see Figure V-15**)**. It uses the substrate and its microbial action to filter and break down or assimilate pollutants. Stormwater is routed to or flows overland through a vegetated strip to the basin, then enters a shallow basin consisting of a prepared planting bed, organic mulch and woody and herbaceous plant species. Water is detained, passing slowly through the soil medium and allowing the physical and biological processes in the facility to enhance water quality before discharge.



Design Objectives:

- Establish a grass strip to intercept surface runoff entering the basin, reducing flow velocities, and filtering out sediments.
- Construct a deep, planting soil mixture that supports desirable vegetation and permits infiltration to subgrade or underdrain.
- Create a terrestrial forest ecosystem consisting of canopy and understory trees, shrubs and ground cover, planted in a shallow, mulch layer.

Considerations:

- The use of this type of facility is not recommended on slopes greater than 5:1.
- Special attention to erosion and sediment control is critical for those areas tributary to the basin in order to prevent silt loads from clogging the basin.
- A bioretention basin can be established either on-line or off-line of the stormwater system. To prevent clogging, pre-treatment (vegetated filter strips, bioswales, etc.) may be required of the first flush.
- Basin size is determined by drainage area and runoff characteristics.
- Multiple bioretention basins may be required for larger drainage areas.

Design Standards:

- Design the basin so that:
  - A grassed buffer strip intercepts overland flow from paved surfaces.
  - Its maximum ponding depth is six inches.
  - Standing water at or near the surface should be eliminated within 72 hours to avoid mosquito proliferation.
- Use the following specifications for planting soil:
  - Soil should be two to three feet deep and four inches deeper than the largest root ball.
  - It should be sandy loam, loamy sand or loam texture with clay content ranging from 10 to 25 percent and a sand content of approximately 50 percent.
  - Planting soil should have infiltration rates of 0.5 inches per hour or greater.
  - The soil pH should be between 5.5 and 6.5, with approximately 1.3 to 3 percent organic content.
- Add a 2 to 3 inch layer of fine shredded mulch as a top layer in the basin.
- Vegetate the bioretention facility to create a terrestrial forest community, with a minimum of three species of trees and a shrub to tree ratio of 2:1 to 3:1.
- Install perforated pipe underdrains in the facility, unless it is constructed in sandy soils.

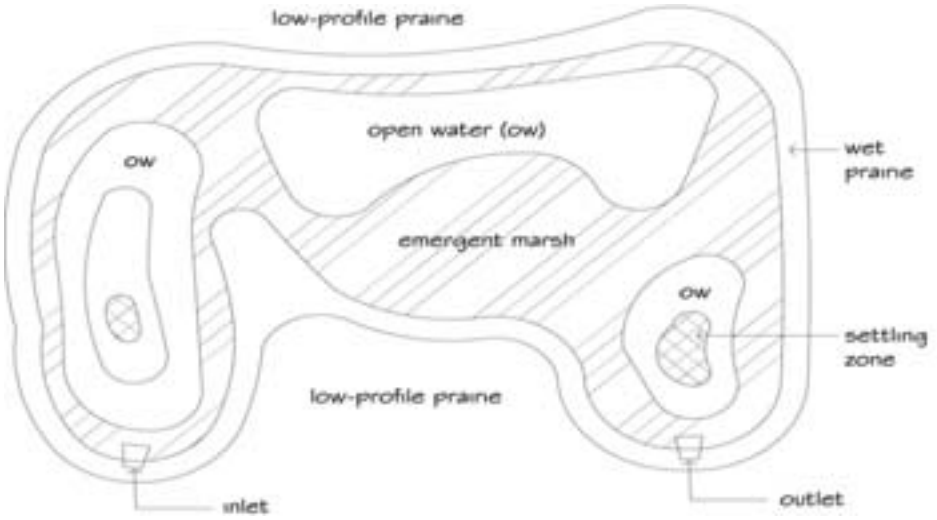
- The shape of the basin should be a curved configuration following natural contours.
- Final design specifications to be determined by the Department of Water Management.

Planting Recommendations:

Components	Plant Community	Design Standards
Vegetated Buffer Strip	Low-Mow Turf ***OR***	Seed: 5 lbs. per 1000 s.f.
	Low-Profile Prairie Mix # 7	Plugs: 50 per acre in 2.5 " containers @ 24" o.c. (avg.)
Basin	Overstory Trees, Woody Plant List #2 or #3	3" caliper, 1 tree per 1000 s.f.
	Intermediate Trees, Woody Plant List #1 or #4	6' ft. B&B; 3 trees per 1000 s.f.
	Deciduous Shrubs, Woody Plant List #1 or #4	30" ht,, 10 per 1000 s.f.
Groundcover		Seeds: 44.57 lbs. per acre
Basin Slopes	Low-Profile Prairie # 2	Seed: 41.38 lbs. per acre
		Plugs: 50 per acre in 2.5" containers @ 24" o.c. (avg.)
Basin Bottom	Wet-Mesic Prairie Mix # 5	Plugs: 225 per acre in 2.5" containers @ 24" o.c. (avg.)

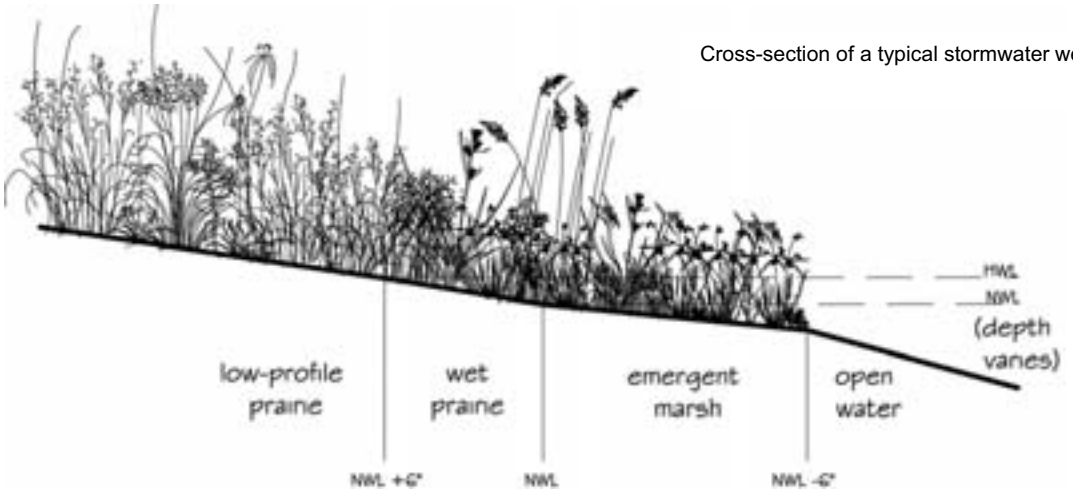
Stormwater Wetland

Of the wetland basin types listed in Table 2, Stormwater wetlands are the preferred option in the Calumet area as they are designed specifically to receive and treat stormwater runoff (see Figures V-16 and V-17). Water quality improvement is achieved through a combination of settling, microbial action and pollutant assimilation by wetland plants. Stormwater wetlands are designed to accommodate lower water quality and frequent fluctuations in water level. They can be an aesthetic feature, offering wildlife habitat as well as functioning as part of the stormwater management system.



Design Objectives:

- Construct a wetland system that is capable of detaining the design storm.
- Design stormwater wetlands with natural, curvilinear configurations and contours, and avoid steep slopes and angular geometric shapes.
- Provide water quality enhancement to stormwater entering the wetland basin through a design that encourages the settling of particulates and biological assimilation of nutrients.
- Provide both upland and wetland habitat for wildlife.
- Create an aesthetic feature as part of the stormwater management system.
- Install native landscaping to minimize maintenance costs.



Cross-section of a typical stormwater wetland

Considerations:

- Wetlands receiving high levels of pollutants should be separated from groundwater to avoid contamination.
- Maintaining appropriate normal water levels is most easily accomplished by using a controlled outlet, allowing excess water entering the basin to discharge downstream.
- Plant materials will need to be selected based on the anticipated hydrologic regimen of the specific basin and its associated moisture gradient.
- Shallow marsh communities may need to be protected from waterfowl through the use of net or wire mesh planting enclosures until such time as the plants become well established.

Design Standards:

- Route enough stormwater to the wetland basin to maintain a permanent pool.

- Design the wetland basin and discharge to permit water levels under the 10-year, 24-hour duration storm event to rise and return to near normal water level (NWL) within a 24-hour period.
- Establish a pretreatment forebay at the basin's inlet, sized to hold approximately ten percent of the permanent pool volume.
- Provide access for periodic maintenance and silt removal as necessary from the forebay.
- Maintain a minimum length to width ratio of 1.5:1 for the main body of the wetland.
- Provide a wetland surface area that is at least one percent of drainage area.
- Maximize the distance between inlet and outlet to avoid short-circuiting of flows.
- Create variable planting depths throughout body of basin ranging from + 6 inches to - 6 inches from normal water level.
- Create deeper zone near outlet to permit additional settling of particulates.

Planting Recommendations:

Components	Plant Community	Design Standards
Top of Slope to 6" above NWL	Low-Profile Prairie, Mix # 2	Seed: 41.4 lbs. per acre Plugs: 50 per acre in 2.5" containers @ 24" o.c. (avg.)
6" above NWL to NWL	Wet-Prairie, Mix # 2	Seed: 43.4 lbs. per acre
NWL to 6" below NWL	Emergent Marsh, Mix # 2	Seed: 5.6 lbs. per acre Plugs: 4000 per acre in 2.5" containers @ 24" o.c. (avg.)

Vegetated Filter Strip

A vegetated filter strip is a linear vegetated area separating an up-gradient pollution source or development from any adjacent water resources such as a waterway or perhaps a wetland on the Calumet Open Space Reserve (see Figure V-18**)**. Vegetated filter strips intercept surface flow, filtering out a portion of the sediment load and increasing opportunities for infiltration.

Design Objectives:

- Filter out pollutants between developed areas of the site and wetland or surface water body.
- Ensure filter strip is fully vegetated (not spotty) to meet design objectives.

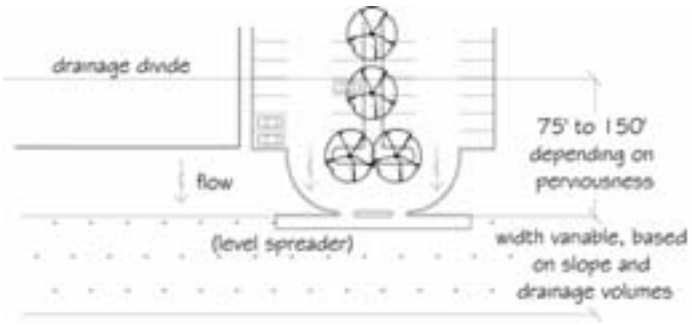


Figure V-18: Use a vegetated filter strip to filter out pollutants between a developed area and adjacent water body

Considerations:

- To operate effectively, only sheet flow should pass through the filter strip.

- This feature is not appropriate where high velocities of surface runoff will occur.
- The use of a level spreader at the upper edge of the strip is recommended, because it can help maintain sheet flow (see Figures V-18 and V-19, next page).
- The water-quality enhancement functions of a vegetated filter strip are appreciably reduced on slopes of greater than ten percent.

Design Standards:

- Ensure that the drainage area is five acres or less.
- Use a level spreader at the upper edge of the strip to help maintain sheet flow.
- Design the filter strip so that the:
  - Length of the vegetated strip (perpendicular to flow) extends the entire length of the impervious surface from which stormwater originates.
  - Flow length (parallel to flow) of areas draining to a filter strip is no more than 75 feet for impervious areas and no more than 150 feet for pervious areas.
  - Optimum width is based on the water quality design storm (up to a 2-year storm event) and a hydraulic radius equal to a design flow depth of less than or equal to 0.5 inches.
  - Minimum width is 25 feet.
  - Slope is greater than one percent, but less than five percent.

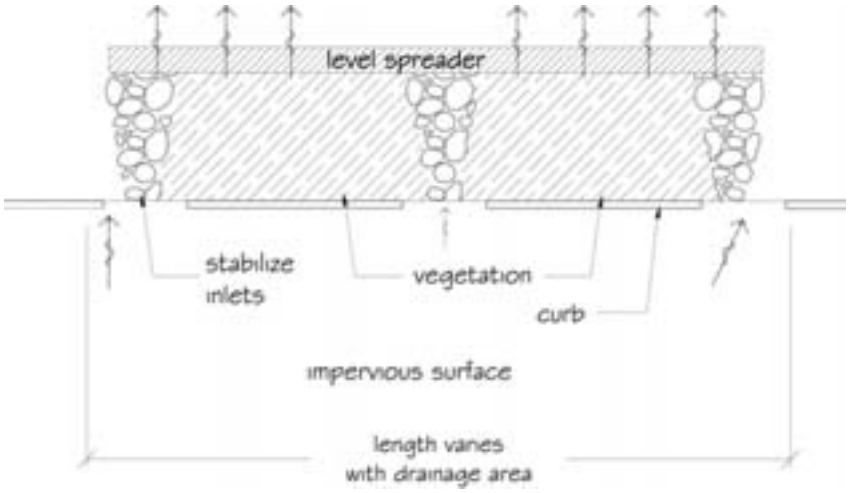
Planting Recommendations:

Use one or more components as appropriate to site conditions:

Components	**Plant Community**	**Design Standards**
Groundcover	Low-Profile Prairie Mix # 4 ***OR***	Seed: 47.7 lbs. per acre Plugs: 50 per acre in 2.5" containers @ 24" o.c. (avg.)
	Mesic Prairie Mix # 1 ***OR***	Seed: 47.95 lbs. per acre Plugs: 50 per acre in 2.5" containers @ 24" o.c. (avg.)
	Mesic Prairie Mix # 2 ***OR***	Seed: 47.95 lbs. per acre Plugs: 50 per acre in 2.5" containers @ 24" o.c. (avg.)
	Wet-Mesic Prairie Mix # 3 ***OR***	Seed: 44.59 lbs. per acre Plugs: 50 per acre in 2.5" containers @ 24" o.c. (avg.)
	Wet-Mesic Prairie Mix # 4	Seed: 49.93 lbs. per acre Plugs: 100 per acre in 2.5" containers @ 24" o.c. (avg.)

Level Spreader

A level spreader is a water management feature that assists in the interception and collection of moderately concentrated flows of surface runoff and disperses the runoff in a uniform manner to the adjoining landscape **(**see Figure V-19). Although not water quality enhancement features themselves, level spreaders improve the effectiveness of other BMPs that depend on sheet flow to operate (e.g., vegetated filter strips). Level spreaders may be used at the edges of parking lots, loading areas, driveways or other discharge points where it is desirable for a point source discharge to be spread over a larger horizontal area. This feature consists of a deep, gravel-filled trench, running perpendicular to the direction of concentrated flow. Water entering the trench spreads evenly along its axis before it infiltrates into surrounding soils.

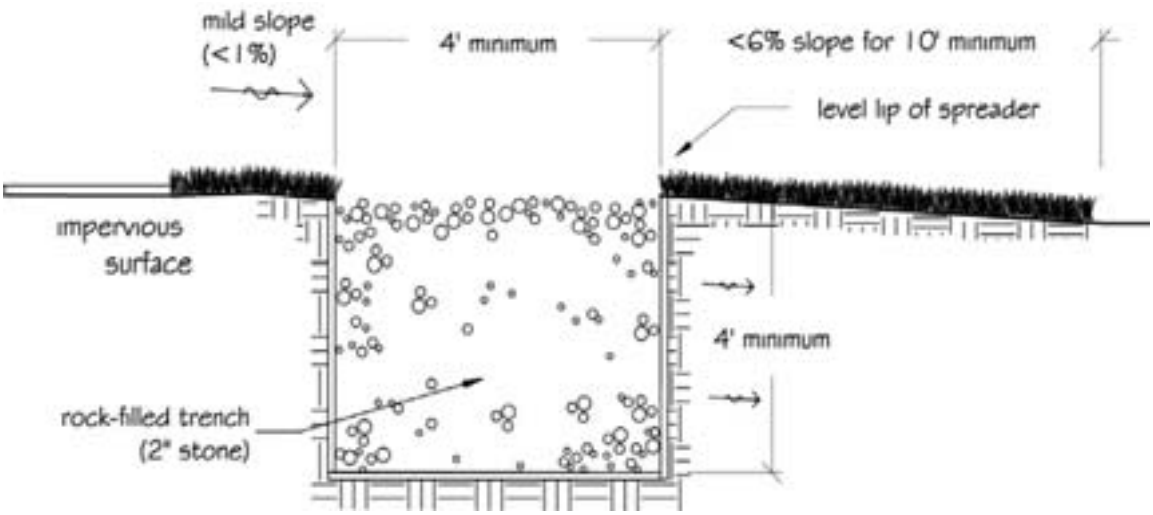


Design Objectives:

- Establish a linear trench with the capacity and porosity to capture, disperse and discharge surface runoff.
- Maximize design compatibility with surrounding landscape by planting trees and shrubs to soften exposure of linear aggregate.

Considerations:

- The level spreader must be absolutely level to avoid ponding and reconcentration of flows.
- Areas tributary to level spreaders should be stabilized to avoid erosion.
- Flows to the level spreader should be free of sediments.
- Level spreaders must be maintained at a level elevation to avoid the re-concentration of flows and the creation of gullies. If gullies start to develop, they must be repaired immediately.



Cross-section of a typical level spreader

Design Standards:

- Base the length of a level spreader on a 10-year design flow, adjusting for the drainage area as follows:

Drainage Area (acres)	Minimum Length (feet)
1	10
2	10
3	15
4	18
5	20

- Design the slopes that lead to the level spreader as follows:
  - The slope upgradient from the level spreader should be less than 1 percent for at least 20 feet; and
  - The slope downgradient should be 6 percent or less.

Management And Maintenance

Trees and Shrubs

Naturalized plantings of trees and shrubs require less intensive maintenance. After establishment of new plantings, the following general maintenance operations should be incorporated into the overall facility maintenance program.

Watering – After the establishment period has concluded supplemental watering during the first growing season is recommended. This will be especially important during hot dry periods of the year. Watering weekly for the first growing season when a one-inch rain is not received is recommended.

Pruning/Trimming – Woody plants will require a yearly program to remove dead wood and excess growth to maintain a open healthy canopy. This program should be performed primarily in the late fall and winter. Supplemental spot pruning/trimming may need to be done to remove dead branches that may present a safety concern. Pruning/trimming should be done to maintain the natural character of the plant.

Supplemental Planting – In order to maintain the character of the landscape periodic planting of additional trees and shrubs will need to be done. Budgeting of annual supplemental planting for the first five years should be anticipated. Once the canopy's of the trees grow and provide a more dense cover additional shade tolerant species of shrubs and groundcover may need to be planted.

Low-Mow Turf

Establishment – Low mow turf should be seeded between late August and late September for best results. March through mid May is also a good planting timeframe, however may require additional establishment activities since most weeds also germinate at this time.

Watering – New seed installations should be watered daily for the first six weeks. Water application rates should consist of fifteen to thirty minutes unless the soil is damp and watering rates should be adjusted. After the first six weeks watering may be cut back to every two to five days until establishment based on weather conditions.

Fertilizer & Weed Control – Fertilizer is not recommended and weed control should be applied on an as needed basis only for specific problems.

Mowing – Mowing operations should never remove more than one third of the top growth. Mowing is generally required once per growing season for general clean-up.

Integrated Pest Management (IPM) – The use of chemical applications should be considered as the last resort for spot treatment of infestation. Biological and non-toxic chemicals should be the first choice in pest management. Careful and regular monitoring of the landscape will assist in the early detection of problems.

Natural Areas

Natural landscape maintenance is different from traditional landscape maintenance. Natural landscape can reduce maintenance costs associated with traditional landscaping; however, just like any other

plantings natural landscapes require management and maintenance. Long-term, the maintenance requirements of natural communities are generally much less than those of more ornamental landscaping. During the first few years, more weeds will be evident than prairie plants and more intensive maintenance will be required. Maintenance efforts will likely decrease beginning around Year Three following installation. To promote successful establishment, the services of a qualified native restoration professional will be invaluable as the installed native community evolves. With respect to management, the initial priority should be to establish a matrix of grasses; supplemental wildflowers can be added later if desired.

The type of maintenance required depends on the system. A typical outline of management following native seed installation is presented below. As with installation guidelines, no "recipe" can be provided for natural area management and maintenance. However, the basic rule of thumb is that weeds must be controlled or the native community will not establish. Once established, native plants can out-compete most weeds that remain.

An EPA publication (http://www.epa.gov/glnpo/greenacres/toolkit) provides valuable information on selecting assistance for your natural landscaping project; sources of information and assistance; sources of native seeds, plants, and garden catalogs; and a selected biography.

Typical Maintenance Requirements:

Year 1

1) Mow (4-6 inches, late April-mid May) (following a fall seeding only).

2) Mow (8-10 inches), when cover crop and weeds are 1 to 2 feet high, usually once in mid- to late June and again between 15 July and 15 August (depending on how weather affects plant growth).

3) Mow – September (optional).

4) Weed control (mowing should keep down annual weeds; spot wick thistles, etc., spray application may be more efficient for larger areas but must be done in a manner that does not adversely affect desirable plants).

5) Watering (may be necessary during first two months of spring or summer planting when seed has germinated or plugs have been installed but are in early growth and a drought or heat wave begins).

Weeds should not be allowed to grow higher than 12 to 14 inches (even if this means sacrificing some of the short-term wildflowers), or they will deprive the prairie of light and water. A qualified, native landscape maintenance company should be contracted to perform weed control, as it is critical that the maintenance company have experience in recognizing prairie plants from weeds. A flail (preferred) or rotary mower should be used rather than a sickle-type mower, which leaves "hay" that will smother prairie plant seedlings. Cover crop should develop within two weeks of planting (except in dormant seedings). Seedlings should be spaced 1-6 inches apart in drill rows. Native grass seedings may be only 4 to 6 inches tall. Most prairie plants are warm season plants and do not begin growth until warm weather arrives. If there is a flush of growth from foxtail, etc., mowing should occur more often. Cuttings should not be left if they will smother the small prairie seedlings. Watering should only be performed during the morning, never at night. Once prairie plants develop their root systems, they will not need watering. In fact, excessive water can produce unappealingly tall, lanky plants.

Year 2:

1. Conduct a spring prescribed burn if sufficient fuel exists. If not, mow (3-4 inches in late March or early April).
2. Mow 4-6 inches in late April-mid May, if needed).
3. Mow (6-10 inches), June 15-August 15 if weeds are thick.
4. Mow – September (optional).
5. Weed control (mowing should keep down annual weeds; spot wick thistles, etc.).
6. Some sites may not require much maintenance the second year.

The cover crop will be gone. Grasses should form clumps 1 to 6 inches apart in drill rows but still short. Some flowers should bloom (e.g., black-eyed Susan, sand coreopsis, bergamot, etc.). If there is a flush of foxtail growth, mow the site.

Years 3-5

1. Mow only if and where necessary (spot treatments).
2. Weed control (spot treatment of thistles, etc.).
3. Conduct prescribed burn in spring or fall.
4. Maintenance efforts should begin to decrease.

At this stage, planting should begin to look like a prairie (i.e., tall grasses, flowers, etc.). During this "establishment phase" the prairie should be burned annually for five to six years. Burning should be performed by qualified personnel incorporating all appropriate safety precautions. Unless the site manager is trained in managing controlled burns by the U.S.D.A. Forest Service or other qualified agency, the site manager should contract with a qualified native landscape maintenance company. A prescribed burn permit must be obtained from the Illinois Environmental Protection Agency, and permits will likely be required from the fire and police departments.

Most existing woodlands are best initially managed by regular burning, understory re-seeding (as needed), and weed control. Created woodland areas will need reseeding and/or supplying woodland plugs approximately 10 or so years down the road because shading will make prairie elements disappear/decrease.

Long-Term Maintenance

1. Mow prairies only occasionally (spot treatments may be necessary).
2. Weed control (spot treatment of thistles, woody invasives, etc.).
3. For prairies, conduct prescribed burn in spring or fall (annual burn preferred, but at minimum every three years, alternating spring and fall burns); early fall haying may substitute for burning on occasion. Burning a prairie two years in a row will "clean up" rough-looking sites.
4. Wetlands may be burned in spring or fall. A fall burn may be more successful as water levels are typically lower.

5. Mature woodlands should be burned only in the fall, with the leaves used for fuel. Immature or created woodland and riparian areas should be managed as prairies until the canopy develops and the plant community shifts.

Once a prairie is well established (typically after five years), maintenance involves occasional mowing or controlled burning to maintain native plant diversity and control weeds. Certain noxious weeds may need focused control such as selective use of an appropriate herbicide. Fertilization is not needed for areas with native plantings, and should not be performed except as directed by an ecologist. Burning should be "prescriptive" (i.e., conducted to achieve specific goals such as targeting particular weed species, encouraging development of grasses or wildflowers, etc.). Prairie plants are generally free of pests and diseases, so insect control is not appropriate and may harm desirable insects.

Mechanical Control – Mechanical control of nuisance plant species typically includes mowing and/or the digging up individual plants by hand. In many cases, mowing a plant before its seeds mature will minimize further spread. Mowing at or very close to the ground surface with a weed-eater or hand-scythe can be an effective means of control for species such as sweet clovers, various thistles, and ragweeds. For general mowing of swaths of vegetation, mowers should be set to a height of 12+ inches above the ground surface or to a height that treats weedy species yet minimizes impacts on desirable plants.

For species such as common reed, purple loosestrife, Canada thistle, and reed canarygrass, mowing actually encourages the spread of underground stems. Hand pulling or digging out these species and woody undesirables such as multiflora rose can be used as an effective means of control if there are fewer than 100 plants throughout the entire site. Where more than 100 individuals of such plants are present, chemical control should be the primary method of control.

Chemical Control – Because of the potential for damage to native plant communities, the use of preventative herbicides should be limited to problem areas and problem species where manual measures are ineffective. Manual weed removal and prescribed burning are preferred means of vegetation management. Aquatic herbicides should not be used to treat algal blooms.

Employed in conjunction with prescribed burning and mechanical control, the judicious use of herbicides can be an important component of management programs for controlling invasive species. Some species, such as purple loosestrife, buckthorn *(Rhamnus* spp.) and honeysuckle (*Lonicera* spp.), reed canarygrass, common reed, sandbar willow, and cattails are controlled more effectively by chemical treatment than by mechanical control measures.

Glyphosate herbicide (trade names Rodeo or Roundup) is often recommended for use in native areas. Other herbicides such as Transline, Plateau, and Garlon also have been used in natural areas. The application of herbicides should be performed only by a licensed professional applicator according to approved rates and procedures. Herbicide application should be conducted in strict compliance with all warning labels and applicable codes, standards and best management practices.

Generally, wick application is more selective than spray application. Wicking applies herbicide only to individual plants, using a canvas-covered, perforated, chemical filled PVC pipe. Trained personnel walk the area, swinging the eight-foot pipe from side to side above the native plants but deliberately striking invasive species. The pipe strikes and bends the weeds, smearing them with the chemical and destroying them within a few days. Spray applications, if used, should not be conducted on windy days because non-target species could be affected.

Biological Control – An alternative to chemical treatment, use of biological controls for purple loosestrife should be considered provided site conditions are appropriate to support and maintain the insect population. Through this method, host-specific insects (one a root infesting weevil; others are leaf-eating chrysomelid beetles) are released to feed on the roots or leaves of purple loosestrife. If purple loosestrife becomes abundant, biological control can prove a cost-effective means of management.

Stormwater Best Management Practices

The landscape treatments and systems recommended within this document will require certain management and maintenance activities in order to assure their long-term performance. By making a commitment to regular management and maintenance, individual property owners will be able to:

1. Achieve the desired design results.
2. Prolong the optimal function of landscape designs and treatments.
3. Avoid significant repair and restoration costs.
4. Maintain the aesthetic qualities of the overall landscape.

The following regular activities should be considered as part of the standard management protocols for recommended landscape features:

Vegetated Swales:

Annually:

- Burn or mow.
- Replant sparsely growing areas.
- Repair eroded slopes or bottom.
- Disk or aerate of swale bottom.

Five Year Cycle or As Needed:

- Re-grade and remove sediment to establish original cross-section.
- Replant to restore groundcover.

Bioretention:

Annually or as Needed:

- Repair eroded areas.
- Check mulch and add as needed to maintain 2 to 3 inches of depth.
- Remove and replace all dead or diseased plants.

Permeable Pavers:

Weekly – Sweep or clean surface to remove accumulated dirt or debris.

Monthly – Mechanically remove any vegetation establishing in gravel spaces.
Five to Ten Year Cycle or as Needed – Remove, clean and replace aggregate between pavers.

Stormwater Wetland:

Annually:

- Burn sideslopes initially on an annual basis, then every other year once established.
- Monitor the establishment of native wetland and prairie vegetation until prescribed levels of growth are achieved; replant as necessary for long-term viability and sustainability.
- Treat or remove invasive vegetation.
- Monitor and repair under cut or eroded slopes and damaged embankments.
- Inspect and repair water level control structures.
- Clean out inlet and outlet devices.

Five Year Cycle or As Needed – Remove sediment accumulated in forebays and settling areas every five years or as needed.

Vegetated Filter Strips:

Annually:

- Burn or mow.
- Remove litter or debris.
- Aerate soil biannually.
- Repair eroded areas.
- Replant sparsely vegetated areas.